Detailed Syllabus

Course Code	15B11CI513	Semester Even	Semester 6th Session 2021 -2022 Month from January-22 to June-22
Course Name	Software Engineering		
Credits	4	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Dr. ShulabhTyagi (62), Dr. Mukta Goyal (128)
	Teacher(s) (Alphabetically)	Dr. Shruti Jaiswal, Mr. Ashish Kumar Tripathi, Ms Shruti, Mr. Ashish

COURSE OUTCOMES		COGNITIVE LEVELS
C314.1	Explain software engineering principles and software process models for project development.	Remembering(Level 1)
C314.2	Identify functional and non-functional requirements of a software project and design document software requirements specification.	Understand (Level 2)
C314.3	Design, represent and document software requirements specification. Plan and execute activities for a software project.	Create (Level 6)
C314.4	Apply UML modeling for software design from software requirements specification.	Apply(Level 3)
C314.5	Analyze code checklist. Perform code Reviews, Code Refactoring, and Code optimization, design pattern	Analyze(Level 4)
C314.6	Apply testing principles, develop and implement various manual and automated testing procedures, formal methods	Apply(Level 3)
C314.7	Evaluate software in terms of general software quality attributes and possible trade-offs presented within the given problem.	Evaluate(Level 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Unit-1	**Introduction to Software Engineering:** Introduction to software engineering Principles, Software process models(build and fix model,waterfall model, Incremental process model, Evolutionary- Prototype and Spiral models, Agile Models (tools study). Project planning, Project Scheduling: network diagram, Gant Chart, CPM and PERT.	7
2.	Unit-2	**Requirement Engineering:** Types of requirement, Requirement Elicitation, Analysis, Specification, SRS, Requirement Verification and Validation.	4
3.	Unit-3	**Software Design:** Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Component Diagram and Package diagram. Design Modularity: Coupling Cohesion.	7
4.	Unit-4	**Software Construction:** Coding standards and guidelines, Code checklist, Code Reviews, Code Refactoring, Code optimization.Design	8

		pattern, Modern programming environments (Code search, Programming using library components and their APIs), Program comprehension; Program correctness, Defensive programming.	
5.	*Unit-5*	***Software Metrics:*** Size-Oriented Metric, Function-oriented Metric, Halstead's Software Metric, Information Flow Metric, Object-oriented Metric, Class-Oriented Metric, COCOMO Model.	7
6.	*Unit-6*	***Software Testing:*** White-Box Testing, Basis Path Testing, Control Structure Testing: Condition Testing, Data Flow Testing, Loop Testing, Black-Box Testing: Equivalence class partitioning, Boundary Value Analysis, Decision table testing, Cause effect graphing, Mutation Testing and regression Testing, formal methods**.**	9
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments/Tutorial/ Mini Project : 15, Attendance : 10)
Total	**100**

Project based learning: Each student works on different case study in Tutorial and Assignments. They utilize the concepts taught in lecture and develop project in a group of 3-4.

The course emphasized on the skill development for employability in software industry by engaging students on Software Development methodologies. Various activities are carried out to enhance the student's software development skills. Some of them are study of various software process models and their applicability, progress tracking, size estimation techniques, software testing strategies, etc.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
Text Book(s):	
1.	Roger S. Pressman, "Software Engineering: A practitioner approach", Fifth Edition-TMH International .
2.	Sommerville , "Software Engineering" , Seventh Edition - Addison Wesley.
Reference Book(s):	
3.	Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Addison Wesley, Reading, Massachusetts, May 2005
4.	Richard Thayer , "Software Engineering Project Management", Second Edition -Wiley-IEEE Computer Society Press.
5.	B. Bezier, "Software Testing Techniques", Second Edition- International Thomson Computer Press.
6.	Pankaj Jalote, "An Integrated Approach to Software Engineering" Third addition , Springer Press

Detailed Syllabus

Subject Code	15B11CI514	**Semester: EVEN**	**Semester** EVEN **Session** 2021-2022

		(specify Odd/Even)	Month from February 22 to June 22
Subject Name	ARTIFICIAL INTELLIGENCE		
Credits	4	Contact Hours	3+1

Faculty (Names)	Coordinator(s)	Dr. Swati Gupta/ Dr. Satish Chandra
	Teacher(s) (Alphabetically)	Dr. Swati Gupta/ Dr. Satish Chandra

COURSE OUTCOMES		COGNITIVE LEVELS
C312.1	Design, implement and analyze the problem solving agents using various informed, uninformed search strategies.	Analyzing [Level 4]
C312.2	Analyze and apply algorithms to solve problems requiring evolutionary search strategies, constraint satisfaction and game theory.	Analyzing [Level 4]
C312.3	Represent knowledge and Apply inference mechanisms using propositional logic (PL) and first order predicate logic (FOPL).	Apply [Level 3]
C312.4	Apply model of probabilistic reasoning in incomplete and uncertain environment.	Apply [Level 3]
C312.5	Develop the agents with natural language processing and learning capabilities.	Apply [Level 3]

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction	History and foundations of AI	01
2.	Problem solving and intelligent agents	PEAS, Structure of agents, nature of environments, concept of rationality	03
3.	Problem solving-I	Problem solving agents, Uninformed search strategies (BFS, UCS, DFS, DLS, IDS)	04
4.	Problem solving-II	Informed Search and Exploration (GBFS, Heuristic function, A*, RBFS, Hill climbing, Genetic Algorithms)	06
5.	Problem solving-III	Constraint satisfaction problems (backtracking search), Adversarial Search (optimal decision in games, alpha beta pruning)	05
6.	Propositional Logic	Knowledge based agents, Propositional Logic, First order Logic, Syntax and Semantics), Inference in FOPL (Unification, forward and backward chaining, resolution)	05
7.	Knowledge representation	Ontology, actions, situations and events, time and event calculus, mental events,	03
8.	Uncertainty	Inference using full joint distribution, Probabilistic reasoning, Bayesian rule, Bayesian network, Maximum likelihood estimation	04
9.	Learning	decision tree, ensemble learning, K-	07

10.	Natural Language Processing	Nearest Neighbor, K-Means algo, Reinforcement Learning	
		Preprocessing, POS tagging using MLE, Parsing using CYK	04
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance (10 Marks), Assignment/Quiz/Mini-project (15Marks))
Total	100

Project Based Learning component- Students made project in a group of 3-4 members. Projects are made by applying the concepts learned in class to real life applications like stock prediction, customer recommendation, gamming etc. This helps their employability in IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Artificial Intelligence – A modern approach by Stuart Russel and Peter Norvig, PHI, 2008.
2.	Artificial Intelligence: foundations of computational agents, Cambridge University Press, 2017
3.	Artificial Intelligence Review: An International Science and Engineering Journal, Springer
4.	Minds and Machines: Journal for Artificial Intelligence, Philosophy and Cognitive Science, Springer
5.	IEEE Intelligent Systems

Software Engineering Lab (15B17CI573)
Detailed Syllabus

Course Code	15B17CI573	Semester: Even	Semester:VI Session:2021 -2022 Month from Feb to May
Course Name	Software Engineering Lab		
Credits	0-0-1	Contact Hours	2

Faculty (Names)	Coordinator(s)	Dr. Bhawna Saxena (J62), Dr. VartikaPuri (J128)
	Teacher(s) (Alphabetically)	J62: Anuja Arora, Bhawna Saxena, Indu Chawla, PurteeKohli, Sonal, Sulabh Tyagi
		J128: Ashish Kumar, Himanshu Agrawal, Mukta Goyal, Shruti Jaiswal, VartikaPuri

COURSE OUTCOMES		COGNITIVE LEVELS
C374.1	Explain software engineering principles and software process models for project development, software requirements specification for a software project	Understand Level (Level 2)
C374.2	Apply software design and modeling.	Apply Level (Level 3)

C374.3	Apply software optimizing and refactoring	Apply Level (Level 3)
C374.4	Apply testing principles and implement various testing procedures	Apply Level (Level 3)
C374.5	Creation of software using software engineering principles	Create (Level 6)

Module No.	Title of the Module	List of Experiments	CO
1.	Introduction to Software Engineering Principles	Introduction to software engineering Principles (evolution, failures, changing nature of software, software myths, product, process, software crisis and need of testing), Software process models (build and fix model, waterfall model, Incremental process model, Evolutionary- Prototype and Spiral models, Agile models – extreme programming and scrum, selection of a life cycle model), PSP, TSP. Types of requirement, Feasibility studies, Requirement Elicitation, Analysis, Specification, SRS, Requirement Verification and Validation.	C374.1
2.	Software Design andModeling.	Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Event trace diagram. Size oriented metrics, LOC, token count, Function Count, cost estimation, data structure metrics, Halstead's Software Metric, Information Flow Metric, Overview of Quality Standards like ISO 9001, SEI-CMM, COCOMO, COCOMO-II, Software risk management	C374.2
3.	Software Optimizing and Refactoring	Coding standards and guidelines, Code checklist, Code Refactoring and Code optimization	C374.3
4.	Software Testing	Black box testing techniques: Equivalence class testing, Boundary value analysis, Decision table testing, Cause effect graphing, White box testing: Path testing, Data flow and mutation testing, Levels of testing- unit testing, integration and system testing, Debugging- techniques, approaches, tools & standards.	C374.4

Evaluation Criteria

Components	Maximum Marks
Lab Test 1	20
Lab Test 2	20
Day-to-Day	60 (Attendance (10), Evaluation/ Viva (20), Project (30))
Total	**100**

Project based learning: Each student in a group of 3-4 have to work on a mini-project, in which they will create Software Requirements Specification (SRS) document and design the software diagrams. Further, the software implementation should be followed with testing reports. This

enhances the understanding of students towards different software engineering concepts and also help them during their employability.

	Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
1.	Pressman, Roger S. Software engineering: a practitioner's approach. Palgrave Macmillan, 2005.
2.	Jalote, Pankaj. An integrated approach to software engineering. Springer Science & Business Media, 2012.
3.	KK Aggarwal, Software Engineering, 2001.
4.	David Solomon and Mark Russinovich ," Inside Microsoft Windows 2000", Third Edition, Micorosoft Press
5.	https://www.tutorialspoint.com/software_engineering/
6.	ACM/IEEE transactions on Software Engineering
7.	ACM Transactions on Software Engineering Methodology
8.	Springer Journal of Empirical Software Engineering
9.	Springer Journal of Software and Systems Modeling

Detailed Syllabus

Course Code	15B17CI574	Semester EVEN (specify Odd/Even)	Semester 6th Session 2021-2022 Month Jan to June
Course Name	Artificial Intelligence Lab		
Credits	1	Contact Hours	2

Faculty (Names)	Coordinator(s)	Pratistha Verma, Raju Pal
	Teacher(s) (Alphabetically)	Pratistha Verma, Dhanlaxmi G, Raju Pal

COURSE OUTCOMES		COGNITIVE LEVELS
C372.1	Construct problem solving agent using various Informed and uninformed search strategies	Apply Level (C3)
C372.2	Utilize evolutionary search algorithms to solve the real world complex problems	Apply Level (C3)
C372.3	Analyze and apply algorithms to solve problems requiring constraint satisfaction and game theory	Analyze Level (C4)
C372.4	Demonstrate and understand the inference mechanisms using propositional and first order logic	Understand(C2)

Module No.	Title of the Module	List of Experiments	No. of Lab hours for the module	CO
1	Introduction to Programming in Python	Familiarize the following concepts of Python programming language like Arrays, Lists, functions, Tuples, Dictionary, Sets, Objects and classes	2	C372.2
2	Problem solving	Problem solving agents, Uninformed search strategies (BFS, UCS, DFS, DLS, IDS) Informed Search and Exploration (BFS, A*, IDA*, SMA*,IDA*)	4	C372.3
3	Evolutionary Algorithms	Genetic Algorithms	2	C372.3
4	Constraint satisfaction problems	Formulating Problems as constraint satisfaction problems	2	C372.4
5	Adversarial Search problems	Adversarial Search (optimal decision in games, alpha beta pruning)	4	C372.3
6	Knowledge representation	Inference using Prolog	2	C372.2

Evaluation Criteria

Components	Maximum Marks
Evaluation 1	15
Lab Test 1	20
Lab Test 2	20
Mini-project	15
Evaluation 2	15
Attendance	15
Total	**100**

Project Based learning:

In this subject, students work in a team of 3-4 people, to implement a small application/mini-project based on AI. Projects are made by applying the concepts learned in class to real life applications like automated hardware based application, stock prediction, recommendation system, gaming etc. This helps their employability in the IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
1. Artificial Intelligence – A modern approach by Stuart Russel and Peter Norvig, PHI, 2008.
2. Artificial Intelligence: foundations of computational agents, Cambridge University Press, 2017
3. Artificial Intelligence Review: An International Science and Engineering Journal, Springer
4. Minds and Machines: Journal for Artificial Intelligence, Philosophy and Cognitive Science, Springer
5. IEEE Intelligent Systems

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B19CI691	Semester Even (specify Odd)	Semester VI Session 2020 -2021 Month from Jan to June
Course Name	Minor Project-II		
Credits	2	Contact Hours	4

Faculty (Names)	Coordinator(s)	ANKIT VIDHYATHI, VIMAL KUMAR, HIMANI BANSAL
	Teacher(s) (Alphabetically)	ALL FACULTY

COURSE OUTCOMES		COGNITIVE LEVELS
C350.1	Analyze chosen literature addressing real world research problem to identify the requirements	Analyzing Level (4)
C350.2	Build technical report detailing the software specification, design, test plan, and implementation details.	Creating Level (6)
C350.3	Build a practicable solution for the research problem	Creating Level (6)
C350.4	Evaluate results to test the effectiveness of the proposed solution	Evaluating Level (5)
C350.5	Develop effective communication skills for presentation of project related activities	Apply Level (3)

Evaluation Criteria

Components	Maximum Marks
Viva-1	20
Viva-2	20
D2D	60
Total	**100**

Project based learning: Each student in a group of 3-4 will have to develop a Minor Project based on different engineering concepts. The students can opt any real-world application for the implementation of Minor Project. The students have to implement the real world problem using any open-source programming language. Project development will enhance the knowledge and employability of the students in IT sector.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NHS 531	Semester :Even (specify Odd/Even)	Semester : VI Session:2021 -2022 Month from: Feb- June 2021
Course Name	Sociology of Youth		
Credits	3	Contact Hours	(3-0-0)

Faculty	Coordinator(s)	Prof Alka Sharma

(Names)	Teacher(s) (Alphabetically)	Prof Alka Sharma Shikha Kumari

COURSE OUTCOMES		COGNITIVE LEVELS
C304-13.1	Demonstrate an understanding ofYouth and youth culture in sociological perspectives	Understanding(C 2)
C304-13.2	Explain the ethical, cultural& social issues concerning Youth	Evaluating(C 5)
C304-13.3	Examine the relative importance of structure and agency in shaping young people's experiences and life opportunities	Analyzing(C 4)
C304-13.4	Evaluate youth experience in a context of social change	Evaluating(C 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Youth	Meaning and characteristics of youth, demographic profile of youth in India, Challenges faced by Youth, Youth's roles and responsibilities in society	4
2.	Youth Culture	Concept of Youth Culture, role of Popular culture in shaping youth culture,	4
3.	Perspectives on Youth Culture	Functionalist, Conflict, Interactionist and Feminist Perspective on Youth Culture, Youth and Gender	5
4.	Youth and Identity	Social divisions: sexuality, urban and rural youth, social identities: subcultural, digital, Experiences of youth to negotiate identities in contemporary societies	8
5.	Socialization of Youth	Concept and processs of socialization, Internalization of norms, types of socialization, conditions of learning, internalized objects, theories of socialization, stages of socialization, adult socialization, agents of socialization, role of culture in socialization, socialization and cultural differences, importance of socialization, Failure of the socialization process	9
6.	Problems of Youth	Role and Value conflicts, Generation Gap, Career decisions and Unemployment, Emotional adjustment, Coping with pressures of living, Unequal Gender norms, Crime (Social Strain theories),	8
7.	Changing perceptive of Youth and Youth Culture in 21st century	involvement of youth in major decision making institutions, Post-modernity and Youth, Youth Unrest	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20 (Project based)
T2	20
End Semester Examination	35
TA	25 (Presentation, Assignment, attendance, Quiz and Participation in Tutorial)
Total	**100**

PBL- Each student will identify the variables shaping their identity and aspirations. In what ways do they do this? (Another way to think about this question: How do these social forces or institution provide you with the chance to pursue your goals? How do they limit your life chances?)

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Tyyskä, V. *Youth and Society: The long and winding road*, 2nd Ed., Canadian Scholars' Press, Inc. (2008).
2.	White, Rob, Johanna Wyn and Patrizia Albanese. *Youth & Society: Exploring the Social Dynamics of Youth Experience.* Don Mills, ON: Oxford University Press, 2011.
3.	Bansal, P.*Youth in contemporary India: Images of identity and social change*. Springer Science & Business Media, 2012.
4.	Furlong, Andy. *Youth studies: An introduction*. Routledge, 2012.
5.	Blossfeld, Hans-Peter, et al., eds. *Globalization, uncertainty and youth in society: The losers in a globalizing world*. Routledge, 2006.
6.	Ruhela, Satya Pal, ed. Sociology of the teaching profession in India. National Council of Educational Research and Training, 1970.
7.	Frith, S. "The sociology of youth. Themes and perspectives in sociology." Ormskirk, Lancashire: Causeway Books ,1984.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NHS631	**Semester Even**	**Semester 6th Session** 2021 -2022 **Month from January 2022to June 2022**
Course Name	PROJECT MANAGEMENT		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Deepak Verma, Dr. Swati Sharma
	Teacher(s) (Alphabetically)	Dr. Deepak Verma, Dr. Swati Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-5.1	Apply the basic concepts of project management such as features, objectives, life cycle, model and management, in a given context	Apply Level (C3)
C304-5.2	Analyze projects and their associated risks by understanding the various theoretical frameworks, non-numerical and numerical models in order to make correct selection decisions	Analyze Level (C4)
C304-5.3	Evaluate the stages of project management and identify and determine correct techniques for planning and scheduling	Evaluate Level (C5)
C304-5.4	Evaluate management processes for budgeting, controlling and terminating projects in order to achieve overall project success	Evaluate Level (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Project Management: Introduction	Characteristics of project; Life Cycle of Project; Project Model; Project Management as discipline; Contemporary aspects of Project Management	4
2.	Project Selection	Theoretical Models; Non-numeric models; Numeric Models; Financial Models; Project Portfolio process, Significance and applicability of Monte Carlo simulation	6
3.	Project Organization, Manager and Planning	Pure Project organization; Functional Organizations; Mixed organizations; Matrix organizations; Role, Attitudes and Skills of Project Manager, Project Coordination, Systems Integration, Work Breakdown Structure, Linear Responsibility Charts.	4
4.	Risk Management	Theoretical Aspects of risk, Risk Management process, Numeric Techniques, Hillier model, Sensitivity Analysis, Certainty Equivalent approach and Risk adjusted discount rates, Game theory.	4
5.	Project Scheduling and Resource Allocation	Theoretical aspects-Importance, Focus Area-PERT/CPM, AOA and AON charts, Probability Analysis, Gantt Charts, Crashing of Projects- Time and Cost tradeoff, Basics-Resource Leveling and Loading.	6
6.	Budgeting, Control and Project Termination	Estimating Project Budgets, Improving the process of cost estimation, Basics, Importance, Purpose of control, Types of Control, Desirable features of Control, Control Systems, Critical Ratio Method, Control of creative activities, Control of change and scope creep, Why Termination, Types of termination, typical termination activities.	4
Total number of Lectures			**28**

Project Based Learning: Students are supposed to form a group (Maximum 5 students in each group) and identify a real-life project. They are supposed to do the in-depth study of this project and assess it in terms of project objectives. They are supposed to do the detailed study of project planning and project organization. They must highlight the various tools and techniques of Project planning, which are used in their chosen project. The fundamentals of Project management are very important in today's corporate world and certainly this subject enhances student's employability in every sector.

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Project, Oral Questions)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Meredith, Mantel, Project Management-A Managerial Approach, 10th Edition, Wiley Publications,2017
2.	Timmothy Kloppenborg, Contemporary Project Management, 5tht Edition, Cengage Learning, 2017

3.	Harold Kerzner,Project Management: A Systems Approach to Planning, Scheduling, and Controlling,12th Edition,Wiley Publications,2017
4.	Wysocki,R.K., Effective Project Management: Traditional, Agile, Extreme, Hybrid, 8th Edition, Wiley Publications,2018
5.	Vohra, N. D., Quantitative Techniques in Management, 5thEdition, Tata McGraw Hill Publishing Company, 2017

Detailed syllabus
Lecture-wise Breakup

Subject Code	16B1NHS632	Semester: EVEN	Semester 6th Session 2021-22 Month from Jan to June
Subject Name	COGNITIVE PSYCHOLOGY		
Credits	3	Contact Hours	2-1-0
Faculty (Names)	Coordinator(s)	Dr. Badri Bajaj (JIIT-62) Dr. Amba Agarwal (JIIT-128)	
	Teacher(s) (Alphabetically)	Dr. Amba Agarwal Dr. Badri Bajaj Dr. Monali Bhattacharya	

COURSE OUTCOMES		COGNITIVE LEVELS
C304-4.1	Understand and apply the concepts of cognitive psychology in everyday life	Applying Level (CL3)
C304-4.2	Analyze the different models of various cognitive processes	Analyzing Level (CL4)
C304-4.3	Evaluate cognitive psychology issues and recommend possible solutions	Evaluating Level (CL5)
C304-4.4	Evaluate interventions/solutions for self-development through cognitive processes	Evaluating Level (CL5)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction to Cognitive Psychology	Historical Background: Emergence of modern cognitive Psychology; Approaches: Information Processing and PDP Model; Research Methods	3
3.	Perceptual Processes	Perceptual learning and development;	4

		perception of shape, space, and movement.	
3.	Attention	Selective Attention and Divided Attention: Meaning, Definition, and Theories.	**4**
4.	Memory	Short Term Memory	**3**
5.	Imagery	Properties of mental images; Representation of images and cognitive maps.	**3**
6.	Language	Structure of language and its acquisition, speech perception, factors affecting comprehension.	**4**
7.	Thinking and Problem Solving	Types of thinking; Classification of problems; Problems solving approaches, Problems space theory by Newell and Simon, Creativity	**4**
8.	Decision Making	Logical reasoning types and errors in reasoning processes. Concept formation and categorization; Judgment and decision making	**3**
Total number of Hours			**28**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Assignment, Class partcipation)
Total	**100**

Project based learning: Students in a group will choose a research topic from the syllabi of cognitive psychology. Students will cover the following points to prepare project reports: Understanding of concept, related theories and perspectives; Describe the relevance of the chosen concept for personal growth; Discuss the application of chosen topic for your professional life; Elaborate the relevance of the topic at group level and societal level. Discussions on these practical aspects will enhance students' understanding & application of concepts of cognitive psychology in everyday life.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Ronald T. Kellogg, Fundamentals of Cognitive Psychology, 3rd Ed., Sage Publishing, 2015
2.	Robert Solso, Otto Maclin, M. Kimberly Maclin, Cognitive Psychology, 8th Ed., Pearson Education, 2013

3.	Kathleen M. Galotti, Cognitive Psychology, 5th Ed., Sage Publishing, 2014
4.	Michael W. Eysenck, Mark T. Keane, Cognitive Psychology: A Student's Handbook , 7th Ed, Psychology Press, 2015
5.	Robert Sternberg, Karin Sternberg, Cognitive Psychology, 6th Ed, Wadsworth/Cengage Learning, 2011
6.	Edward E. Smith, Stephen M. Kosslyn, Cognitive Psychology: Mind and Brain, Ist Ed, Pearson Education India; 2015

Detailed SyllabusLecture-wiseBreakup

Course Code	16B1NHS634	SemesterEven(specifyOdd/Even)	SemesterSession2021-2022 MonthfromFebruary toJuly
CourseName	TheatreandPerformance (Valueadded)		
Credits	2	ContactHours	1-0-2

Faculty(Names)	Coordinator(s)	DrNilu Choudhary and Dr. Ankita Das
	Teacher(s) (Alphabetically)	Dr. Ankita Das and Dr. Nilu Choudhary

CO Code	COURSEOUTCOMES	COGNITIVELEVELS
C304-14.1	Demonstrateproblemsolvingabilityandeffectivelifeskillsthroughtheatreperformances.	Understandinglevel(C2)
C304-14.2	Developawareness oftheroleoftheseartsinhumanlife	Understandinglevel(C2)
C304-14.3	Apply skills of listening, articulation, awareness and collaborationthroughthe creation of performance.	Applyinglevel(C3)
C304-14.4	Design and present an original performance alone or in collaborationwithother artists.	Creatinglevel(C6)

Module No.	Title of theModule	TopicsintheModule	No. ofLectures forthemodule
1.	Introduction ofTheatre	Historyoftheatre:roleoftheatreinhumanculturewithspecialreference toIndia	2
2.	Characterization	Tipsfordevelopingcharacter,thinkingaboutthoughts,Flash–back, Performance	2

3.	ScriptWriting	Turninga storyintoa play,Howto writea oneAct , settingthescene,character,stagedirection,Dialogues	3
4.	Schoolof Drama	Natya-Shastra,StanislavskyandBrecht	3
5.	Text and itsinterpretation	Mother Courage,Galileo ,AadheAdhure(anyone)	3
6.	Back-stage work	Management,planning,execution	1
		TotalnumberofLectures	**14**

Module No.	Titleofthe Module	ListofExperiments/Activities	CO
1.	Moving inSpace.	Students will be moving around the room, filling up thespace, changing pace, changing direction, being aware ofother people but not touching them. Find new ways ofmoving, with a different emphasis each time – smooth,jagged, slow, fast, heavy, light, high up, low down and soon.EverynowandagainTeacherwillshout"Freeze!And Studentsneedtofreezeeverymuscleinyour body.	**C304-14.1**

		AbsolutelyNOLAUGH,LOOKINGAROUND,OR MOVING.Youwill beout.	
2.	MirrorActivity	Agreatwaytogetstudentsawareofbodymovementandworkingtogether.	**C304-14.1**
3.	Characterization	Developing and analyzing characters to reveal the specialqualitiesandpersonalitiesofthecharactersinastory,makingcharacterbelievable.	**C304-14.2**
4.	ScriptWriting	The more passionate you feel about your idea, the moreattractiveyourplaywillbe.Dividetheideaintoabeginning, middle and end.	**C304-14.3**
5.	RoleAssignment	No acting or movement at this point – just sit together tospeak and hear the script carefully. Discuss and clarify anyconfusing aspects of the script and any apparent challengesinbringingthescripttothestage.Divisionofscriptinto small"units"andrehearsedseparately	**C304-14.3**
6.	Turningstoryintoaplay	Readthrueachepisodeorunitseparately"onitsfeet".Actorsmovingaroundthestagespace.Setblockingfor each episode.Use ideas generated from Mini-Episodes,andStagingwithImages.Makesurethegestures, movements,andstagepicturestellthestoryclearly.	**C304-14.3**
7.	Stageblocking	Practice the blocking and the lines so that everyone knowswhathappenswhenandwhattheirperformanceresponsibilitiesare.Memorizelines.Workonmakingcharacters, relationships, and dialogue clear.This is a goodplace in which to use the Creating the Character lessons. Payattentiontovocalprojectionandarticulation.Generate ideas about any technical elements you want to incorporateusingtheTransformationof Objects.	**C304-14.3**
8.	Scripttoperformance	Finalizeandruntheentireplayfrombeginningtoendwithoutstopping tocheckanyadditionalrehearsalrequired togeteverythingrunningsmoothlyornot.FinallyPerform!!	**C304-14.4**

EvaluationCriteria

Components	**MaximumMarks**
Mid Term	30
End Term	40
TA	30(Scriptwriting,Endtermstageperformance)
Total	**100**

Project Based Learning: Students will be given a project in a group of 5-6 which would require them to use their imagination to form original stories with relatable characters and convert it into a script to be performed as a play. While putting together an entire performance would help them in learning organizational lessons such as team work, their efforts towards developing relatable characters would help them in analyzing the varied experiences and emotions of human life.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Textbooks, ReferenceBooks, Journals,Reports,Websitesetc.intheIEEEformat)	
1.	Eric Bentley, ed., The Theory of the Modern Stage: An Introduction to Modern Theatre and Drama,Penguin Books,1968
2.	MarkFontier,Theory/ Theatre: AnIntroduction,NewYork: Routledge,2002

3.	MichaelHolt,StageDesignandProperty,Oxford:Phaidon,1986
4.	MichaelHolt,CostumeandMake-up,Oxford: Phaidon,1988
5.	Natyashastra,tr.byAdyaRangacharya,NewDelhi: MunshiramManoharlal,1996,
6.	G.J Watson, Drama: An Introduction. Macmillan International Higher Education, 2017.
7.	Micheal Mangan, The Drama, Theatre and Performance Companion. Basingstoke: Palgrave Macmillan, 2013.
8.	Kenneth Pickering Key Concepts in Drama and Performance. New York: Palgrave Macmillan, 2010.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NHS635	Semester: Even	Semester: VI Session: 2021 -2022 Month: Feb to June
Course Name	Organizational Behavior		
Credits	3	Contact Hours	3(2-1-0)

Faculty (Names)	Coordinator(s)	Dr Anshu Banwari
	Teacher(s) (Alphabetically)	Dr Anshu Banwari

COURSE OUTCOMES		COGNITIVE LEVELS
C304-6.1	Identify dynamic human behavior through an insight into relationships between individuals, groups and organizations	Apply (C3)
C304-6.2	Analyze individual management style as it relates to influencing and managing behavior in the organization.	Analyze (C4)
C304-6.3	Decide and justify set of strategies for meeting the special challenges in the 21st century competitive workplace	Evaluate (C5)
C304-6.4	Assess the potential effects of important developments in the external environment on behavior in organizations	Evaluate (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1	Introduction to OB: Challenges and Opportunities	Interdisciplinary Field, Concepts, Approaches, Responding to Globalization; Improving Quality & Productivity; Improving Customer Service; Improving People Skill; Empowering People; Stimulating Innovation & Change; Coping with Temporariness; Positive Organizational Behavior, Working in Networked Organizations; Balancing Work-Life Conflict	3
2	Managing Workforce	Major forms of Workplace Diversity, Valuing Diversity,	4

	Diversity	Diversity Awareness and Affirmative Action, Diversity Management and strategies to implement it Competitive Advantage of Diversity Management Generational Workforce	
3.	Job Design and Flexible Job Environment	Job Design & its uses; Flexible Job Environment; Job Enrichment Model	2
4.	Leadership: Authentic Leadership	Inspirational Approach to Leadership: Authentic, Ethical & Servant Leadership Defining Authentic Leadership through Intrapersonal, Interpersonal and Developmental Aspects; Basic Model of Authentic Leadership; Practical Approach to Authentic Leadership through the research of Terry and Bill	6

		George; Authentic Leadership: Trust and Ethics, Dimensions of Trust, Counseling & Mentoring	
5.	Power & Politics	Concept of Power; Sources of Power Contingencies of Power; Power Tactics; Measuring Power Bases: Power Authority Obedience Organizational Politics: Types Factors contributing to Political Behavior; Consequences & Ethics of Politics	5
6.	Employee Engagement	Creating a Culture of Engagement, Models of engagement, Benefits of Employee Engagement, Gallup Study, Methods of engaging employees – from entry to exit, Managers Role in Driving Engagement	2
7.	Organizational Culture & Workplace Spirituality	Creating Organizational Culture Approaches to Organizational Culture; How employees learn culture; Measuring Organizational Culture; Spirituality & Organizational Culture	3
8.	Organizational Change & Development	Organizational Change: Meaning & Types; Technology & Change; Resistance to Change v/s Inviting Change; Approaches to Organizational Change; Planning & Implementing Change; Organizational Development; OD Interventions & Change	3
		Total number of Lectures	**28**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Project)
Total	**100**

Project based learning: To Identify the behavioral strategies adopted by a specific corporate/ business leader for his organization to meet the challenges of the 21st century competitive workplace and achieve the tangible outcomes of productivity and employee wellness within his organization.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.

2.
3.
4.
5.
6.

S. Robbins, T. Judge, S. Sanghi, *Organizational Behavior*, 13th Ed, Prentice-Hall India, 2001

P.Subba Rao, *Organizational Behavior: Text Cases & Games*, 2nd Edition, Himalaya Publishing House , 2015
John R. Schermerhorn, Richard N. Osborne, Mary Uhl-Bien; James G. Hunt, *Organizational Behavior*, 12th Edition, Wiley India Pvt. Ltd, 2012
Debra L.Nelson and James C. Quick, *Organizational Behavior*, Cengage Learning, India Edition, 2009
Steven L. McShane and Mary Ann Von Glinow, *Organizational Behavior Essentials*, Tata McGraw Hill Publishing Company Ltd, 2007
Jerald Greenberg, *Behavior in Organizations*, 10th Ed, PHI Learning Pvt Ltd

Statistics (16B1NMA633)

Course Description

Course Code	16B1NMA633	Semester: Even	Semester VI Session 2021-22 Month from Jan 2022 - June 2022
Course Name	Statistics		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr.Anuj Bhardwaj	
	Teacher(s) (Alphabetically)	Dr. Himanshu Agarwal, Dr. Anuj Bhardwaj	

COURSE OUTCOMES		COGNITIVE LEVELS
After pursuing the above mentioned course, the students will be able to:		
C302-1.1	make use of measures of central tendency, dispersion, skewness and, kurtosis for description and visualization of population data.	Applying Level (C3)
C302-1.2	apply correlation and regression in statistical analysis of data.	Applying Level (C3)
C302-1.3	explain sampling theory and its distributions.	Understanding Level (C2)
C302-1.4	explain the concepts and properties of estimation theory.	Understanding Level (C2)
C302-1.5	apply sampling and estimation theory to find the confidence interval.	Applying Level (C3)
C302-1.6	analyze small and large sample data by using the test of hypothesis.	Analyzing Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Descriptive Statistics	Graphical representation such as histogram, frequency polygon, AM, GM, HM, median, mode, measures of dispersion, skewness and kurtosis such as central and non-central moments, population variance, β, γ coefficient, Box and Whisker plot.	8
2.	Correlation and Regression Analysis	Scatter diagram. Karl Pearson's and Spearman's rank correlation coefficient, regression lines, regression coefficient and their properties.	5
3.	Sampling and Sampling Distributions	Populations and Sample, random sample, statistics, sample moments, law of large numbers, central limit theorem, distribution of sample mean and sample variance, MGF, Chi-square distribution, F-distribution, Student's *t* distribution.	7
4.	Parametric Point Estimation	General concept of point estimation, methods of moments and maximum likelihood for finding estimators, unbiasedness, consistency, efficiency, UMVUE, Cramer-Rao inequality, sufficiency, factorization theorem, completeness, Rao-Blackwell theorem.	10
5.	Parametric Interval	definition of confidence interval, pivotal quantity,	5

	Estimation	confidence interval for mean, variance, difference of means and difference of variances for small and large samples.	
6.	Hypothesis Testing	The basic idea of significance test. null and alternative hypothesis, type-I and type II errors, testing of small and large samples for mean, variance, difference in means, and difference in variances.	7

Total number of Lectures			**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials)
Total	**100**

Project based learning: Students in a group of 4 will collect sample data set and make simple regression models. They will validate the model by hypothesis testing. By this students will be able to make simple linear regression models and validate it.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**Biswas and Srivastava**, A Textbook, Mathematical Statistics Ist Edition, Narosa Publishing House, New Delhi.
2.	**W. Feller**, Introduction to Probability Theory and its Applications Vol. I and II. Wiley Eastern-Ltd, 1971
3.	**V. K.Rohatgi**, An Introduction to Probability Theory and Mathematical Statistics Wiley Eastern, 1984
4.	**R. V. Hogg, A. T. Craig,** Introduction to Mathematical Statistics, McMillan, 1971
5	**AM. Mood**, **F. A. Graybill, and D. C. Boes**, Introduction to the Theory of Statistics McGraw Hill, 1974
6.	**Des Raj &Chandak**, Sampling Theory, Narosa Publishing House, 1998.
7.	**Sheldon Ross**, A First Course in Probability, 10th edition, Pearson Education Asia, 2018.
8.	**Meyer, P.L**, Introductory Probability and Statistical Applications Addison-Wesley Publishing Company, 1965.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NPH632	**Semester** EVEN	**Semester 6th Session** 2021 -2022 **Month from January to May**	
Course Name	SOLID STATE ELECTRONIC DEVICES			
Credits	3		**Contact Hours**	3
Faculty (Names)	**Coordinator(s)**		Dr. Dinesh Tripathi	
	Teacher(s) (Alphabetically)		NA	

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Define terminology and concepts of semiconductors with solid state electronic devices.	Remembering (C1)
CO2	Explain various electronic, optical and thermal properties of semiconductors; various techniques used in device fabrication.	Understanding (C2)
CO3	Solve numerical problems based on solid state electronic devices.	Applying(C3)
CO4	Examine the impact of various parameters on semiconductor devices and their performances.	Analyzing (C4)

Module	**Title of the Module**	**Topics in the Module**	**No. of Lectures for**

No.				the module
1.	Energy band and charges carriers in conductors	Bonding forces and energy bands in solids, charge carriers in semiconductors, carries concentrations, drift of carriers in electric and magnetic fields, Invariance of the Fermi level at equilibrium, optical absorption, Luminescence, Carrier lifetime and photoconductivity, diffusion of carriers		12
2.	Junctions	Fabrication of p-n junctions, equilibrium conditions, steady state conditions, reverse bias breakdown, recombination and generation in the transition region, metal semiconductor junctions, heterojunctions,		10
3.	Transistors	Field effect transistor (FET), Metal-insulator FET, Metal-insulator-semiconductor FET, MOS FET, Bipolar junction transistors		08
4.	Devices	Photodiodes, solar cell, light emitting diodes, semiconductor lasers, Negative conductance Microwave devices: Tunnel diode, IMPATT diode, Gunn diode		10
			Total number of Lectures	**40**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (5), Attend. (5), PBL (10) and Class performance (5)]
Total	**100**

Project based learning: To make a better understanding about the subject, groups of 4-5 students will be formed and a project on semiconductor devices viz. Gauss meter, Photodiode, Light Emitting Diode, Solar cell, Tunnel Diode, FET, MOSFET etc. will be allotted to each of the groups. The students will collect all the information's and understand about the basic principle, fabrication process and current research activities going on in the particular field. The students will also be encouraged to explore the field and create interactive simulations based on these devices.

Recommended Reading material:

1.	Donald A Neamen&Dhrubes Biswas, Semiconductor Physics and Devices, McGraw Hill Education
2.	S. M. Sze, Physics of Semiconductor devices, Wiley-Interscience
3.	Streetman and Banerjee, Solid State Electronic devices, PHI
4.	Umesh Mishra and Jasprit Singh, Semiconductor Device Physics and Design,

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH633	Semester:Even		Semester: VI Session: 2021-22 Month: January to June	
Course Name	Photovoltaic Techniques				
Credits		3	**Contact Hours**		3

Faculty (Names)	Coordinator(s)	Dr. Bhubesh Chander Joshi & Dr. Prashant Chauhan
	Teacher(s)	Dr. BhubeshChander Joshi & Dr. Prashant Chauhan

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Classify various types of renewable energy sources and explain working of photovoltaic devices.	Understand Level (Level 2)
CO2	Demonstrate the use of basic principles to model photovoltaic devices	Understand Level (Level 2)
CO3	Identify challenges and apply strategies to optimize performance of various type of solar cells	Apply Level (Level 3)
CO4	Analyze Solar PV module, mismatch parameter and rating of PV module	Analyze Level (Level 4)
CO5	Evaluate the performance of various stand-alone PV systems with battery and AC and DC load	Evaluate Level (Level 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Review	Energy issues, conventional energy sources, Renewable energy sources, Solar Energy	02
2.	Solar cell fundamentals	Fundamental of semiconductor, charge carriers and their motion in semiconductors, carriers generation and recombination, p-n junction diode, introduction to solar cell, p-n junction under illumination, Current-Voltage (I-V), open circuit voltage (V_{OC}), short circuit current (I_{SC}) Maximum power, current and voltage and Efficiency, Quantum Efficiency	10
3.	Design of solar cells	Upper limits of cell parameters, loses in solar cell, solar cell design, design for high I_{sc}, V_{oc}, FF, solar simulators	08
4.	Solar cell technologies	Production of Si, Si wafer based solar cell technology, thin film solar cell technologies (CIGS, microcrystalline and polycrystalline Si solar cells, amorphous Si thin film solar cells), multijunction solar cells, Emerging solar cell technologies: organics solar cells, Dye-sensitized solar cell (DSC), GaAs solar cell	12
5.	Photovoltaic system	PV system: Introduction, Stand-alone system, Grid connected system, Hybrid system, Designing of PV system, Balance of system- BOS (Inverters, Controllers, Wiring, Batteries) Photovoltaic Cells, Estimating PV system size and cost, Photovoltaic safety.	08
		Total number of Lectures	**40**

Evaluation Criteria

Components	Maximum Marks	
T1	20	
T2	20	
End Semester Examination	35	
TA	25	[Attendance, Class Test, Quizzes, Internal assessments (15 M),and Assignments in PBL mode (10 M)].
Total	**100**	

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Textbooks, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Tom Markvart and Luis Castaner, "Solar Cells: Materials, Manufacture and Operations," Elsevier, 2006
2.	Stuart R. Wenhem, Martin A. Green, M.E. Watt, "Applied Photovoltaics," Earthscan, 2007

| 3. | Jenny Nelson, "The Physics of Solar Cells" Imperial college press," Aatec publications, 1995. |
| 4. | C S Solanki, Solar Photovoltaics, PHI |

<u>Project based learning:</u> Students will be given a task to design a PV system for the water pump and/or home appliances. This design will help students in understanding the basic knowledge of PV systems, wiring, load calculation, battery sizing, PV panels, etc. It will improve their analytical skills and problem-solving capability and help them in getting jobs in the renewable energy sector.

Course Code	16B1NPH636	Semester: Even	Semester: VI Session 2021 -2012 Month from: January 2022 to June 2022
Course Name	Medical & industrial applications of nuclear radiations		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Manoj Tripathi	
	Teacher(s) (Alphabetically)	Dr. Manoj Tripathi	

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Define nuclear structure, properties and reactions; Nuclear magnetic resonance process.	Remembering (C1)
CO2	Explain models of different nuclear imaging techniques; CNO cycle; principle of radioactive decays.	Understanding (C2)
CO3	Apply knowledge of nuclear reaction mechanisms in atomic devices, dosimetry, radiotracers, medical imaging, SPECT, PET, tomography etc.	Applying (C3)
CO4	Analyze different radiocarbon dating mechanisms and processes.	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Nucleus, Radioactivity & Dating	Structure of matter**;** Nucleus:Nuclear Size, Structure and forces; Binding energy and Nuclear stability, mass defect;Nuclear reaction: Fission, Fusion, chain reaction. Nuclear fusion in stars, Formation of basic elements: proton-proton chain, CNO cycle, Hydrostatic equilibrium; Applications: atom bomb, hydrogen bomb, nuclear power plants, Nuclear reactor problems, precautions. **ii)** Radioactive decay, kinetics of radioactive decay, Types of radioactive decay and their measurement, Half life, decay constant, Population of states, Production of radionuclides. Radioactive dating, Radiocarbon dating: Formation, mechanism of dating, carbon cycle, radiocarbon clock and applications, advantages, disadvantages, precautions; Other dating techniques, protein dating, accuracy in dating;	17
2.	Radiation and matter interactions	Dosimetry and applications: Interaction of Radiation of matter: Biological effects of radiations; dosimetry, working principles, Tools and radiotherapy, Doses, Radioisotopes, Radiotracers;	09
3.	NMR and MRI	Nuclear Magnetic Resonance: General Introduction to Magnetic Resonance, Reference Frame; RF Pulses, Larmor precision, Basic principles of NMR & ESR Spectroscopy, Nuclear shielding, Chemical shifts; Couplings, Nuclear	09

4.	Nuclear Medicine and Nuclear Imaging	Imaging; 1D,2D, 3D Images, Application of NMR in medical industry as MRI, working MRI, Types of differen MRI, Applications of NMR in quantum computation;	
		Nuclear Medicine and Nuclear imaging techniques, preclinical imaging, detector designing, photon counting, Medical imaging using β+γ coincidences, SPECT AND PET: Radiation tomography, applications;	05
		Total number of Lectures	**40**

Evaluation Criteria

Components Maximum Marks

T1   20
T2   20
End Semester Examination 35
TA   25
Total   100

Project Bad Learning:	Different groups of students with 5-6 students in each group may be formed and these groups may be given to complete a task like identifying common applications to nuclear science, recent developments in medical applications, etc. These problem domains (elemental and content analysis, materials modification, radiation gauging, solid/liquid Interface, and heart imaging) may be also chosen based on their potential interest to students. Students may be given a task of presenting the working of devices like MRI, PET scan, X-rays and other imaging techniques. Within each of these problem domains, the students will learn to work in a team. It will improve their analytical skills and the students will learn to achieve their common goal through mutual discussion and sharing of knowledge, information & understanding.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Basic Sciences of Nuclear Medicine; Magdy M K halil, Springer
2.	Physics and Radibiology of Nuclear Medicine; Gopal B Saha, Springer
3.	A. Beiser, Concepts of Modern Physics, Mc Graw Hill International.
4.	Radionuclide Techniques in Medicine, JM McAlister (Cambridge University Press, 1979).
5.	Nuclear Physics; S.N.Ghosal

Employability:	In this course, students learn about the principles and mechanism of working of various medical imaging instruments like MRI, SPECT, PET, PETCT. This course enhances the skill among the students to develop new theories, mechanisms for today's medical industry. By obtaining knowledge in this domain, students may get job opportunity in medical and biomedical industries like nuclear pharmacy, nuclear medicine radiology etc.

Numerical Aptitude (16B19MA691)
Course Description

Course Code	16B19MA691	**Semester** Even	**Semester** –VISession 2021-2022
			Month from Jan 2022- June 2022

Course Name	Numerical Aptitude			
Credits	2		**Contact Hours**	2-0-0
Faculty (Names)	**Coordinator(s)**	Dr.Mohd. Sarfaraz		
	Teacher(s) (Alphabetically)	Dr.Mohd. Sarfaraz		

COURSE OUTCOMES		COGNITIVE LEVELS
After pursuing the above mentioned course, the students will be able to:		
CO1	explain mathematical aptitude.	Understanding Level (C2)
CO2	interpret set theory and different kind of functions.	Understanding Level (C2)
CO3	solve problem on probability theory, quadratic equations and complex numbers	Understanding Level (C2)
CO4	explain surds, inequalities, mensuration, data interpretation and errors.	Understanding Level (C2)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Mathematical Aptitude	Fractions, simplification, HCF and LCM, ratio and proportion, percentage, partnership, age, average, profit and losses, simple interest and compound interest, time and work, time and distance	08
2.	Set Theory	Basics, identities, Venn diagram, addition principle, Pigeon hole principle, Functions-types of functions, some special functions, hashing function, characteristics function, Ackermann's function	05
3.	Representation of Numbers	Representation of numbers in binary, octal, hexadecimal, floating point representation of numbers	05
4.	Probability	Probability, binomial theorem, linear equations, quadratic equations, complex numbers, logarithms.	06
5.	Geometry and Data Interpretation	Inequalities, mensuration, geometry, data interpretation, errors- types of errors, error propagation, errors in series approximation.	06
Total number of Lectures			**30**

Evaluation Criteria

Components   **Maximum Marks**
Mid Term Examination   30
End Semester Examination   40
TA   30 (Assignments)
Total   **100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Project based learning: Students are divided in a group of 4-5 to do a survey on the questions that are available in the GMAT or GATE exams. The student can recognize the problems that appear in competitions and to do good practice to the said problems are learned in this course.

1.	**Aggarwal, R.S.**, Quantitative Aptitude, S. Chand & Co., 2008
2.	**Praveen, R. V.**, Quantitative Aptitude and Reasoning, 3rd Edition, Prentice Hall India, 2016.
3.	**Prakasa Rao, B.L.S.,**A First Course in Probability and Statistics, World Scientific, 2009.

4.	**Rosen & Kenneth H,** Discrete Mathematics and Its Applications, Tata Mc-Graw Hill, New Delhi, 2007.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B19PH692	Semester Even	Semester: VI 2021-2022 Session Month from: January to June
COURSE NAME	LIGHT EMITTING DIODES: BASICS AND APPLICATIONS		
Credits	2	**Contact Hours**	2-0-0

Faculty (Names)	Coordinator(s)	Dr. B.C. Joshi
	Teacher(s) (Alphabetically)	Dr. B.C. Joshi

COURSE OUTCOMES		COGNITIVE LEVELS
C305-6.1	Recall the basic concepts of semiconducting materials, working of p-n junction diode and light emitting diodes.	Remembering (C1)
C305-6.2	Explain the various physical parameters involved in designing and fabrication of LEDs.	Understanding (C2)
C305-6.3	Solve various problems related to efficiency, emission intensity and spectrum of LEDs.	Applying (C3)
C305-6.4	Analyze the problems in designing & fabricating blue, white and green high brightness LEDs.	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	History of LEDs	History of SiC, GaAs, GaAsP, GaInP, GaN, and InGaN LEDs.	4
2.	Theory of Recombination's	Radiative and non-radiative recombination's, Low-level and high-level excitations, Bio-molecular rate equation for quantum well structure, Van Roosbroeck-Shockley Model, Einstein Model.	6
3.	LED Basics	Electrical properties: I-V characteristics, parasitic resistances, carrier distribution in homo and hetero junctions, carrier losses, carrier overflow in heterojunctions, Optical properties: Internal, external, extraction and power efficiencies, Emission spectra, escape cone and temperature dependency	6
4.	Growth & Fabrications	LED materials, Organic LEDs, Growth, Fabrication and Characterization Techniques	4
5.	Applications	Solid state lighting, White LEDs, HB LEDs, Color Mixing and Rendering, LED Drivers, Display Devices, AMOLED, Communication, High Voltage LEDs	10
		Total number of Lectures	**30**

Evaluation Criteria

Components	Maximum Marks
Mid Term Examination	30
End Semester Examination	40
TA	30 [Attendance + Class Tests, Quizzes, *etc*(09 M),Internal assessment and Assignments in PBL mode.
Total	**100**

	Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Textbooks, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
1.	Text 1: Light-Emitting Diodes, Schubert E. Fred, Cambridge University Press, 3rd Edition 2018.
2.	Reference: Introduction to Light Emitting Diode Technology and Applications, Held Gilbert, Auerbach Publications, 2008.
3.	Reference: Light-Emitting Diodes; Materials, Processes, Devices and Applications, Editors: Jinmin Li, G. Q ZHANG, Springer, 2019

Project based learning: In a group of 3 to 5 a task will be assigned to the students, related to design and modelling of light emitting diodes, LED circuits and applications. This will help students in understanding the basic knowledge of LEDs, their working, and applications. Students will learn how to work in groups and this will improve their analytical skills and problem-solving capability.

Subject Code	18B11CS311	Semester: Even	Semester 6th Session Month from Feb-June 2022
Subject Name	Computer Networks and Internet of Things		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	1. Kirti Aggarwal (JIIT 62), 2. Dr. Gaurav Kr. Nigam (JIIT 128)
	Teacher(s) (Alphabetically)	JIIT 62:1.Amarjeet Kaur 2. Dr Apeksha Aggarwal 3. Dr. Vikash 4. Somya Jain 5. Kirti Aggarwal

COURSE OUTCOMES		COGNITIVE LEVELS
C313.1	Defining the basics of networking, components and underlying technologies	Remembering (Level 1)
C313.2	Illustrate the various key protocols in OSI model and TCP/IP protocol suite and explain various application protocols.	Understanding (Level 2)
C313.3	Examine various transport protocols and its performance enhancing mechanisms.	Analysing (Level 4)
C313.4	Determine the shortest path for the network using various routing protocols	Evaluating (Level 5)

	and evaluate it.	
C313.5	Choose IP & MAC addressing mechanisms and data link layer protocols to solve communication, error detection and correction problems.	Applying (Level 3)
C313.6	Identification and description of various components, architectures and protocols of Internet of Things (IoT) and their real life problems.	Understand (Level 2)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction	Network terminologies,Network Models, Protocol layers and their services, Connection Oriented and Connectionlessservices,Physical Media.	04
2.	The Application Layer	Principles of Application-Layer Protocols, HTTP, File Transfer: FTP, DNS, Electronic Mail in the Internet	4
3.	The Transport Layer	Transport-Layer Services and Principles, Multiplexing and Demultiplexing Applications, UDP and TCP, Connection Establishment, Transport Layer Protocols (go back N, stop and wait, selective repeat), Flow Control, TCP Congestion Control	8
4.	The Network Layer	Introduction and Network Service Model, IP: the Internet IP addressing, Routing Principles, Protocol, Routing in the Internet,	08
5.	The Link Layer and Local Area Networks	The Data Link Layer: Introduction, Services, Error Detection and Correction, Multiple Access Protocols and LANs, LAN Addresses and ARP, IEEE standards and Ethernet	06
6.	Introduction to Internet of Things	Introduction to IoT, IoT reference Model - IoT Reference Architecture,M2M architecture, IOT devices	05
7	IoT protocols	Introduction to IOT protocols:IEEE 802.11, LoRaWAN, 6LoWPAN, RPL and MQTT and CoAP	05
Total number of Lectures			**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance = (10), Assignments/Mini-Project/Tutorial/Quiz = (15))
Total	**100**

Project Based Learning: Each student in a group of 2-4 will choose some real-world problems such as congestion control, building smart devices, network traffic analyser etc. for development and analysis. By applying the different network protocol layer concepts and with the help of simulators it helps the students in enhancing their understanding and skills towards networking, communication and IoT related issues leading towards employability in IT and hardware sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1	James Kurose, Keith Ross," Computer Networking: A Top-Down Approach Featuring the Internet ", Addison Wesley

2	Andrew S. Tanenbaum ,"Computer Networks ", Prentice-Hall Publishers
3	Larry Peterson , Bruce Davie ,"Computer Networks a Systems Approach ", Morgan Kaufmann
4	William Stallings ,"Data and Computer Communications", Prentice Hall
5	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017
6	RajkumarBuyya, and Amir VahidDastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12HS611	Semester EVEN (specify Odd/Even)	Semester VI Session2021-2022 Month from : Feb - June
Course Name	Marketing Management		
Credits	3	Contact Hours	(2-1-0)

Faculty (Names)	Coordinator(s)	Dr Swati Sharma
	Teacher(s) (Alphabetically)	Dr. Deepak Verma, Dr Swati Sharma

COURSE OUTCOMES		COGNITIVE LEVELS
C304-7.1	To illustrate the fundamentals of marketing, marketing environment and market research	Understanding Level (C2)
C304-7.2	To model the dynamics of marketing mix	Applying Level (C3)
C304-7.3	To demonstrate the implications of current trends in social media marketing and emerging marketing trends.	Understanding Level (C2)
C304-7.4	To appraise the importance of marketing ethics and social responsibility	Evaluating(C5)
C-304-7.5	To conduct environmental analysis, design business portfolios and develop marketing strategies for businesses to gain competitive advantage.	Creating (C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Understanding New Age Marketing	Defining Marketing For 21st Century The importance of marketing and marketing's role in business and society. Introduction to Digital Marketing. Online Communication Tools. The Social Media-Conversations, Community and Content. Affiliate Marketing and Mobile Engagement. The Digital Campaigns	5
2	Marketing Environment and Market Research	Internal and external forces impacting marketers. Marketing and Customer Value. Gathering Information and Scanning the environment.	3

	and insights	Company's Micro and Macro Environment Responding to the Marketing Environment	
3	**Strategic Planning and the marketing Process**	Explore the impact of social forces on marketing actions. Describe how technological change affects marketing. Designing the business Portfolio Discuss the Strategic Planning Process and Strategic Marketing Process.	5
4	**Consumer and Business Buyer Behaviour**	Consumer Markets and consumer buyer behaviour. The buying decision process. Business Markets and business buyer behaviour. Discuss the modern ethical standards.	5
5	**Branding**	Brand Image, Identity and Association. Product brands and Branding decisions. Product line and mix decisions. Consumer Brand Knowledge. New Product Development and Product life cycle strategies.	4
6	**Pricing products: Pricing considerations and strategies**	Factors to consider when setting prices. New product pricing strategies. Product mix pricing strategies. Price adjustments and changes.	4
7	**The New Age Social Marketing**	Ethics and social responsibility in marketing. Ethical behavior in business. Ethical decision making. Social forces affecting marketing. Impact of culture on marketing. Discuss modern ethical standards. Importance of marketing in CSR and business sustainability.	2
		Total number of Lectures	**28**

Project Based Learning: Students will be assessed on a Project report. The students will present a business plan for a prospective business idea focusing on its marketing strategies applying all the concepts taught in the course

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Project & Viva)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Kotler, Philip and Gary Armstrong, Principles of Marketing, 16th Global Edition, New Delhi, Pearson Education, 20015.

2.	Darymple, Douglas J ., and Leonard J. Parsons, Marketing Management: Text and Cases, 7th Edition, John Wiley & Sons(Asia) Pte. Ltd., 2002.
3.	Kotler, Philip., and Kevin Lane Keller, Marketing Management, 12th Edition, New Delhi, Pearson Education, 2006.
4.	Winer, Russell S ., Marketing Management, 2nd Edition, Prentice Hall,2003.
5	Dalrymple, Douglas J ., and Leonard J. Parsons, 2nd Edition, Wiley Publication, 2000.

Operations Research (18B12MA611)
Course Description

Course Code	18B12MA611	Semester Even	Semester VI Session 2020-21 Month from Jan - Jun 2021	
Course Name	Operations Research			
Credits	3		Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES		COGNITIVE LEVELS
After pursuing the above mentioned course, the students will be able to:		
C302-3.1	construct mathematical models for optimization problems and solve linear programming problems (LPP) using graphical and simplex method.	Applying Level (C3)
C302-3.2	apply two-phase, Big-M and dual simplex method for linear programming problems.	Applying Level (C3)
C302-3.3	make use of sensitivity analysis to linear programming problems.	Applying Level (C3)
C302-3.4	solve transportation, assignment and travelling salesman problems.	Applying Level (C3)
C302-3.5	apply cutting plane and branch & bound techniques to integer programming problems.	Applying Level (C3)
C302-3.6	examine optimality conditions and solve multivariable nonlinear problems.	Analyzing Level (C4)
Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Preliminaries	Introduction, Operations Research Models, Phases and Scope of O.R. Studies.	3
2.	Linear Programming Problems (LPP)	Convex Sets, Formulation of LPP, Graphical Solutions, Simplex Method, Big-M Method, Two Phase Method, Special Cases in Simplex Method.	8
3.	Duality and Sensitivity Analysis	Primal-Dual Relationship, Duality, Dual Simplex Method, Sensitivity Analysis.	8
4.	Transportation Problems	Introduction, Matrix Form, Applications, Basic Feasible Solution- North West Corner Rule, Least Cost Method, Vogel's Approximation Method. Degeneracy, Resolution on Degeneracy, Optimal Solution, Maximization TP Model.	5
5.	Assignment Problems	Definition, Hungarian Method, Traveling Salesmen Problems.	4
6.	Integer Linear Programming Problems	Pure and Mixed Integer Linear Programming Problems, Cutting Plane Method, Branch and Bound Method.	6
7.	Non Linear	Introduction to NLP, convex functions and graphical	8

	Programming	solution, Unconstrained Problem, Constrained Problems - Lagrange Method for equality constraints, Kuhn-Tucker Conditions for inequality constraints, Quadratic Programming -Wolfe's Method	
Total number of Lectures			**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz , Assignments, Tutorials)
Total	**100**

Project based learning: Each student in a group of 4-5 will collect literature on transportation, assignment and integer programming problem to solve some practical problems. To make the subject application based, the students analyze the optimized way to deal with afore mentioned topics.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Taha, H. A. - Operations Research - An Introduction, Pearson Education, 2011.
2.	Hadley, G. - Linear Programming, Massachusetts: Addison-Wesley, 1962.
3.	Hiller, F.S. and Lieberman, G. J. - Introduction to Operations Research, San Francisco, 1995.
4.	Wagner, H. M. - Principles of Operations Research with Applications to Managerial Decision, PHI, 1975.
5.	Vohra, N. D., Quantitative Techniques in Management, Second Edition, TMH, 2003.

Applied Mathematical Methods (18B12MA612)

Course Description

Subject Code	18B12MA612		Semester Even	Semester VI Session 2021-2022
				Month from Feb 2022 to June 2022
Subject Name	Applied Mathematical Methods			
Credits	3		Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)		Dr Vipin Chandra Dubey	
	Teacher(s) (Alphabetically)		Dr Nisha Shukla, Dr Vipin Chandra Dubey	

COURSE OUTCOMES		
After pursuing the above mentioned course, the students will be able to:		**COGNITIVE LEVELS**
C302-4.1	explain the functional and its variations required to optimize the physical problem.	Understanding Level (C2)
C302-4.2	apply different forms of Euler–Lagrange equation on the various variational problems with fixed boundaries.	Applying Level (C3)
C302-4.3	explain different types of integral equations including their conversions from IVP and BVP.	Understanding Level (C2)
C302-4.4	solve Volterra and Fredholm integral equations using various analytical methods.	Applying Level (C3)
C302-4.5	explain various numerical methods along with their stability analysis.	Understanding Level (C2)
C302-4.6	apply different numerical methods for solving differential equations.	Applying Level (C3)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Functional and its Variation	Introduction, problem of brachistochrone, problem of geodesics, isoperimetric problem, variation and its properties, comparison between the notion of extrema of a function and a functional.	8
2.	Variational Problems with Fixed Boundaries	Euler's equation, the fundamental lemma of the calculus of variations, examples, functionals in the form of integrals, special cases contaning only some of the variables, examples, functionals involving more than one dependent variables and their first derivatives, the system of Euler's equations,	5
3.	Variational Problems (continued)	Functionals depending on the higher derivatives of the dependent variables, Euler- Poisson equation, functionals containing several independent variables, Ostrogradsky equation, Variational problems in parametric form, applications to differential equations.	5
4.	Fredholm and Volterra Integral Equations	Introduction and basic examples, Classification, Conversion of Volterra Equation to ODE, Conversion of IVP and BVP to integral equation, decomposition, direct computation, successive approximation, successive substitution methods for Fredholm and Volterra integral equations.	8
5.	Numerical Methods I	Classification of PDEs, Finite difference approximations to partial derivatives. Solution of one dimensional heat conduction equation by Explicit and Implicit schemes (Schmidt and Crank Nicolson methods), stability and convergence criteria.	8
6.	Numerical Methods II	Laplace equation using standard five point formula and diagonal five point formula, Poisson equation, Iterative methods for solving the linear systems. Hyperbolic	8

	equation, explicit / implicit schemes, method of characteristics. Solution of wave equation. Solution of I order Hyperbolic equation. Von Neumann stability.	
Total number of Lectures		**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz , Assignments, Tutorials)
Total	**100**

Project based learning: Students will be divided in the group of 4-5 students to collect the literature and explore the different numerical methods to solve partial differential equations.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**Hilderbrand, F.B.,** Methods of Applied Mathematics, 2ndEdition, Prentice Hall, 1969.
2.	**Gupta, A.S.,** Calculus of Variations with Applications, Prentice Hall of India, 2003.
3.	**Gelfand, I.M.,** Fomin, S.V. Calculus of Variations, Prentice Hall, 1963.
4.	**Elsgolts, L.,** Differential Equations and the Calculus of Variations, Mir Publishers, Moscow, 1973.
5.	**Petrovsky, I.G.,** Lectures on the Theory of Integral Equations, Mir Publishers, Moscow, 1971.
6.	**Smith, G. D.**., Numerical solution of partial differential equations: finite difference methods. Oxford University Press, 1985

<u>Detailed Syllabus</u>

Lab-wiseBreakup

Subject Code	18B15CS311	SemesterEE VEN2022	Semester_VI Session2022 Month: Feb 2022 to June 2022
Subject Name	**Computer Networks and Internet of Things Lab**		
Credits	1	Contact Hours	0-0-2

Faculty(Names)	Coordinator(s)	Ms. Somya Jain and Rupesh Koshariya(J128)
	Teacher(s)	**Ms. Amarjeet Kaur, Dr.Apeeksha Aggarwal, Dr.Kavita Pandey, Ms. Kirti Aggarwal, Dr.Naveen Kr. Gupta, Dr.Parul Agarwal, Ms. Somya, Mr. Vikash, Rupesh Koshariya, Dr Neeraj Jain, Dr Anubhuti, Ms. Anuradha Gupta, Dr Gaurav Nigam, Dr Payal, Ms. Ambalika Sarkar, Mr Bansidhar Joshi**

S.No.	DESCRIPTION	COGNITIVE LEVEL (BLOOMS TEXONOMY)
C373.1	Classify all the wired/wireless technologies and the basic network building blocks	Understand Level (Level 2)
C373.2	Visualize and analyze the data packets of different TCP/IP layers. Store The data packets as*.pcapfiles.	ApplyLevel (Level 3)

C373.3	Create client and server applications using the "Sockets" and the implementation of various protocols at Data link and TCP layer		Analyze Level (Level 4)
C373.4	Implement the working of various sensors and actuators using Arduino and RaspberryPi.		ApplyLevel (Level 3)
C373.5	Design and develop applications for various challenges andproblems related to Sustainable Development		Create (level6)

Module No.	SubtitleoftheModule	Topicsinthemodule	CO
1.	**Introduction**	Introduction to Computer Network devices/ UNIX Commands forTCP/IP Protocol	CO1
2.	**WiresharkSimulator**	Practice onWIRESHARKwithtcp dump : Application Layer,Transport	CO2

		Layer	
3.	**SocketProgramming**	ClientserverprogrammingusingTCP and UDP, Implementingacalculator	CO3
3.	**NetworkSimulator(NS2)**	Introduction,ImplementationofTCP TahoeandReno using ns-2,Performance AnalysisofTCPCongestionControl Algorithm,ImplementationofAQM Algorithmanditsperformanceanalysis, and its performance analysis	CO4
4.	**IOT development boardsandinterfacingwit hsensors**	Arduino Boards, Raspberry Pi. TemperatureSensor,HumiditySensor, Pressure Sensor, Proximity Sensor, Accelerometer, IR Sensor, Optical Sensor, Gas Sensor, SmokeSensor.	CO4
6	**Application developmentw ithLORAkit**	Developing smart applications for variouschallengesandproblemsrelated toSustainableDevelopment,e.g.,energy and waste management, water conservation, smart cities, smart agriculture.	CO5

EvaluationCriteria

Components   **MaximumMarksLa**
bTest-120
LabTest-2
                                                           20
LabEvaluations30Project20Attendance   **10**

Total   **100**

Project based learning: Each student in a group of 4-5 will select an application and analyze the different layers of the network model and how data flows through each in order to make subject application based. Understanding the various challenges and problems related to sustainable development, like energy and waste management, water conservation, smart cities, smart agriculture helps in determining the major
Requirements of the communication sector. This enhances the student's knowledge on of new world data

applications and helps in enhancing their employability in to relatedsector.

RecommendedReadingmaterial: Author(s), Title, Edition, Publisher, Yearof Publication etc. (Textbooks, Reference Books, Journals, Reports, Websites etc. in the IEEEformat)	
1.	James F. Kurose, KeithW.Ross, " Computer Networking: A Top-Down Approach Featuringthe Internet"3rdEditionPearson Education.
2.	Andrew S.Tanenbaum,"ComputerNetworks"4th Edition
3.	UNIX NetworkProgramming, Volume 1, Second Edition:NetworkingAPIs: SocketsandXTI, Prentice Hall, 1998, ISBN 0-13-490012-X.
4.	TeerawatIssariyakul, EkramHossain, "Introductionto NetworkSimulator NS2",Springer.
5.	Anish nath,"Packet Analysis withWiresharkPaperback," Packt Publishing
6.	YoramOrzach, "NetworkAnalysis UsingWiresharkCookbook," Packt Publishing
7	https://www.arduino.cc/en/Tutorial/HomePage
8	https://www.raspberrypi.org/documentation/
9	https://www.dragino.com/downloads/

SYLLABUS AND EVALUATION SCHEME
Lecture-wise Breakup

Course Code	19B12HS611	Semester : EVEN (specify Odd/Even)	Semester: VI Session 2021-22 Month from: Feb-June
Course Name	Econometric Analysis		
Credits	3	Contact Hours	2-1-0

Faculty (Names)	Coordinator(s)	Manas Ranjan Behera
	Teacher(s) (Alphabetically)	Manas Ranjan Behera

COURSE OUTCOMES		COGNITIVE LEVELS
C304-2.1	*Demonstrate* the key concepts from basic statistics to understand the properties of a set of data.	Understanding Level - C2
C304-2.2	*Apply* Ordinary Least Square method to undertake econometric studies.	Apply Level - C3
C304-2.3	*Examine* whether the residuals from an OLS regression are well-behaved.	Analyze Level - C4
C304-2.4	*Evaluate* different model selection criteria for forecasting.	Evaluation Level - C5
C304-2.5	*Create* models for prediction from a given set of data.	Creation Level - C6

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module

1.	Statistical Inference	Point and interval estimation; ;The Z distribution ;The Null and Alternate hypotheses ;The chi-square distribution; The F distribution; The t distribution	3
2.	Regression Analysis	Two variable regression model; The concept of the PRF; Classical assumptions of regression; Derivation of the OLS estimators and their variance; Properties of OLS estimators under classical assumptions; Gauss-Markov Theorem; Tests of Hypothesis, confidence intervals for OLS estimators; Measures of goodness of fit: R square and its limitations; Adjusted R square and its limitations	7
3.	Econometric Model Specification	Identification: Structural and reduced form; Omitted Variables and Bias; Misspecification and Ramsay RESET; Specification test; Endogeneity and Bias	5
4.	Failure of Classical Assumptions	Multi-collinearity and its implications; Auto-correlation: Consequences and Durbin-Watson test ;Heteroskedasticity: Consequences and the Goldfeld - Quandt test	2
5.	Forecasting	Forecasting with a)moving averages b) linear trend c) exponential trend CAGR; Forecasting with linear regression; Classical time series decomposition; Measures of forecast performance: Mean square error and root mean square error; Limitations of econometric forecasts	5
6.	Time Series Analysis	Univariate Time Series Models: Lag Operator, ARMA , ARIMA models, Autoregressive Distributed Lag Relationship	3
7.	Linear Programming	Linear programming; Dual of a linear programming problem; Simplex method Transportation	3
		Total number of Lectures	**28**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz+Project+Viva -Voce)
Total	**100**

Project based Learning: Students have to form a group (maximum 5 students in each group) and have to do an econometric analysis on the topic assigned. Students will use the different statistical methods using quantitative data to develop theories or test existing hypothesis. Students will also be encouraged to forecast future economic trends.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Gujarati, D.N. (2002), Basic Econometric (4th ed.), New York: McGraw Hill.
2.	Greene, W.H. (2003), Econometric Analysis, New Jersey: Prentice Hall.
3.	Madala, G.S. (1992), Introduction to Econometrics (2nd ed.), New York: Macmillan.
4.	Wooldridge,J (2010),Econometric Analysis of Cross Section and Panel Data(2nd ed.), Cambridge, The MIT Press.
5.	Stock, J. H., and M. W. Watson. (2015). Introduction to Econometrics, (Third Update), Global Edition. Pearson Education Limited.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12HS612	Semester:Even	**Semester VI Session** 2021 -2022 **Month from** Feb2022 to June 2022
Course Name	Social Media and Society		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Shirin Alavi
	Teacher(s) (Alphabetically)	Dr. Shirin Alavi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-1.1	Infer the implications of digital change, and the concept of social media and e-marketing in the context of the changing marketing landscape	Apply Level(C3)
C304-1.2	Elaborate the implications of cyber branding and digitization on online marketing mix decisions	Create Level (C6)
C304-1.3	Develop specific models related to social media and social media analytics	Create Level (C6)
C304-1.4	Evaluate concepts related to Search Engine Marketing, Customer Centric Web Business models and Web Chain Analysis	Evaluate Level(C5)
C304-1.5	Illustrate the new age marketing practices	Understand Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction, Individuals Online and Rules for engagement for social media	What is social media marketing, the importance of social media for influencing target audience, Patterns of internet usage, Internet user demographics, The BehaviouralInternet, E-Marketing, The Virtual world, the changing Marketing Landscape, E -Marketing- Strengths and Applications, Online Marketing Domains, Digital Marketing Optimization, The Need for Digital Engagement	4
2.	The Online Marketing Mix	The Online Marketing Mix, Consumer Segmentation, Consumer Traits, Consumers and Online Shopping Issues, E-Product, E-Place, E-Price, E-Promotion,	3

		Website Characteristics affecting online purchase decision.	
3.	The Online Consumer and Social Media	The Digital Ecosystem, Online Consumer Behavior, Cultural Implications of key web characteristics, Models of website visits, Web 2.0 and Marketing, The collaborative web, Network evolution, Network science, Marketing with networks, Metcalfe's law, Netnography, Social Media Model by McKinsey, social media Tools-Blogs, Wikis, Online Communities, Facebook, Twitter, You Tube, Flickr, Microblogging.	4
4.	Online Branding and Traffic Building	Cyberbranding, Online brand presence and enhancement, The Digital Brand Ecosystem, Brand Experience, Brand Customer Centricity, Brands and Emotions, The Diamond Water paradox, Internet Traffic Plan, Search Marketing Methods, Internet Cookies and Traffic Building, Traffic Volume and quality, Traffic Building Goals, Search Engine Marketing, Keyword Advertising, Keyword value, Internet Marketing Metrics, Websites and Internet Marketing.	4
5.	Web Business Models ,Social Media Strategy ,Social Media Marketing Plan	The value of a Customer Contact, Customer Centric Business Management, Web Chain of Events, Customer Value Analysis and the Internet, Business Models, Revenue Benefits, Value Uncertainty, Purchase Importance,Define a social media plan, explain the social Media marketing planning cycle, list the 8C's of strategy development.	4
6.	Market Influence analytics in a Digital Ecosystem	Engagement Marketing through Content Management, Online Campaign Management, Consumer Segmentation, Targeting, and Positioning using Online Tools, Market Influence Analytics in a Digital Ecosystem, The Digital Ecosystem, Knowledge as a value proposition, CGM and Consumer behavior, The value of the power of influence, Amplifying Social Media Campaigns.	4
7.	The Contemporary Digital Revolution and its impact on society	Online Communities and Co-creation, The fundamentals of online community management strategies, The World of Facebook, The Future of Social media Marketing—Gamification and Apps, Game based marketing The world of Apps, Apps and the Indian Diaspora	3
8.	Integrating Mobile into Social Media Marketing	Types of Mobile Marketing, Progression of the mobile as a Marketing channel, some Indian mobile marketing campaigns, Impact of social media on government, the economy, development, and education	2
Total number of Lectures			**28**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Project-Report and Viva)
Total	**100**

Project Based Learning: The project is to be done in a group size of 4 -5 members. Students were asked to identify one brand/company on social media. Read the information available on social media and browse through campaigns. Study the consumer engagement and comments. Write their opinion about it. Analyze the same with a social media tool and compare the results. Also identify and elucidate the strategies used by the brand in the context of online branding. This helped the students to understand concepts of cyber branding and social media analytics and enhanced their employability skills in an organization.

	Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
1.	Digital Marketing, SeemaGupta,First Edition ,Mc Graw Hill Education (India) Private Limited ,2018
2.	Social Media Marketing A Strategic Approach, Melissa Barker,DonaldBarker,Second Edition Cengage Learning ,2017.
3.	Digital Marketing, Vandana Ahuja, First Edition, Oxford University Press, 2015
4.	Social Media Marketing, Liana "Li" Evans,First Edition , Pearson, 2011.

Detailed Syllabus

Course Code	20B12HS311	**Semester** Even **(specify Odd/Even)**		**Semester Session** 2021-22 **Month from** Feb – June2022
Course Name	Global Politics			
Credits	3(2-1-0)		**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	Dr. Chandrima Chaudhuri
	Teacher(s) (Alphabetically)	Dr. Chandrima Chaudhuri Dr.Niti Mittal Ms Rashmi Jacobs

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C304-9.1	Demonstrate an understanding of the meaning and nature of globalization by addressing its political, economic, cultural and technological dimensions	Understanding (C2)
C304-9.2	Analyzing the significance of contemporary global issues	Analyze (C4)
C304-9.3	Analyze how the global politics shapes domestic politics	Analyze (C4)
C304-9.4	Demonstrate an understanding of the working of the global economy, its anchors and resistances offered by global social movements	Understanding (C2)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Globalization: Conceptions and Perspectives	Political Dimension of globalization Globalization and Culture Technological Dimensions Debates on territoriality and sovereignty	6

2.	Global Economy	Its Significance and Anchors of Global Political Economy:IMF- history and India's benefit from its membership of IMF WTO- History and India's experience with WTO and reform proposals World Bank- history and role of world Bank in India Rise of TNCs and role of TNCs in globalization Global resistances (Global Social Movement and NGOs)- their nature and characteristics , prominent movements and their impact	8
3.	Contemporary Global Issues-I	Ecological Issues: historical overview of international environmental agreements-UNSCD, Paris agreement, climate change- Copenhagen summit to post Copenhagen summit policies of India, climate change and global initiatives global commons debate Proliferation of Nuclear Weapons-history of nuclear proliferation, threat of proliferation with increase in globalization	8
4.	Contemporary Global Issues-II	International Terrorism: globalization and global terrorism, impact of terrorism on globalization, role of non-state actors and state terrorism; the US and war on terrorism Migration and Human Security- globalization, violent extremism and migration; new global regime	6
		Total number of Lectures	**28**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz/ Project/Assignment)
Total	**100**

Project Based learning: Each student would form a group of 3-4 students and to make projects on issues such as climate change, terrorism and proliferation of nuclear weapons. This project would help the students in having a better idea about the contemporary global issues and how with the revolution in information and technology as a result of globalization has impacted the world. This would improve their research skills and enhance their knowledge about the impact of globalization on various sectors of the economy.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	C. Hay, Ed. *New Directions in Political Science: Responding to the Challenges of an Interdependent World.* New York, USA: Palgrave Macmillan Education, 2010
2.	D.Held& A. McGrew, *Globalization/Anti-globalization: Beyond the Great Divide*. Cambridge, UK: Polity Press, 2007
3.	F. Halliday, "Terrorism in Historical Perspective".,*Open Democracy*. 22 April, 2004 [Online] Avaliable: http://www.opendemocracy.net/conflict/article_1865.jsp
	H.Shukla, *Politics of Globalization*. Indore, India: Mahaveer Publication, 2021
4.	J. Baylis and S. Smith, Ed.*The Globalization of World Politics: An Introduction to International Relations*. Oxford, UK: Oxford University Press, 2017
5.	L.Gordon and S. Halperin, "Effective Resistance to Corporate Globalisation" in *Contesting Global Governance,* R.O'Brien, A.M. Goetz, J.C. Scholte &M.Williams. Cambridge, UK: Cambridge University Press,2000
	R.Dattagupta, *Global Politics*. Chennai, India: Pearson, 2020

Applicational Aspects of Differential Equations (20B12MA311)

Course Description

Course Code	20B12MA311	**Semester** Even	**Semester** VI **Session** 2021-22 **Month from**Jan 2022 - June 2022
Course Name	Applicational Aspects of Differential Equations		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Shikha Pandey, Dr. Lakhveer Kaur	
	Teacher(s) (Alphabetically)	Dr. Shikha Pandey, Dr. Lakhveer Kaur, Dr. Richa Sharma, Dr. Amit Srivastava	

COURSE OUTCOMES		COGNITIVE LEVELS	
After pursuing the above mentioned course, the students will be able to:			
C302-2.1	solve ordinary differential equations in LCR and mass spring problems.	Applying Level (C3)	
C302-2.2	explain orthogonality of functions and apply it to solve Sturm-Liouville boundary value problems.	Applying Level (C3)	
C302-2.3	apply matrix algebra to find the solution of system of linear differential equations.	Applying Level (C3)	
C302-2.4	formulate and solve first and second order partial differential equations.	Applying Level (C3)	
C302-2.5	evaluate solution of differential equations arising in engineering applications.	Evaluating Level (C5)	
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Basic Theory of Ordinary Differential Equations	Existence and uniqueness of solutions, applications to ordinary differential equations in LCR and mass spring problem.	10
2.	Sturm-Liouville Boundary Value Problem	Sturm-Liouville problems, orthogonality of characteristic functions, the expansion of a function in a series of orthogonal	10

		functions, trigonometric Fourier series.	
3.	Matrix Methods to solve ODE's	Matrix method for homogeneous linear systems with constant coefficients.	4
4.	Basic Theory of Partial Differential Equations	Solution of first order equations: Lagrange's equation, Charpit's method, higher order linear equations with constant coefficients.	4
5.	Applications of Differential Equations	Fourier integrals, Fourier transforms, solution of partial differential equations by Laplace and Fourier transform methods, applications of differential equations in mechanics.	14
Total number of Lectures			**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz , Assignments, Tutorials)
Total	**100**

Project based learning: Each student in a group of 3-4 will apply the concepts of differential equations arising in engineering applications.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**Ross, S.L.,** Differential Equations, 3rd Ed., John Wiley & Sons, 2004.
2.	**Jain, R.K. and Iyengar, S.R.K.,** Advanced Engineering Mathematics, 3rd Ed., Narosa Publishing House, 2012
3.	**Chandramouli, P.N.,** Continuum Mechanics, Yes Dee Publishing India, 2014.
4.	**Kreysizg, E.,** Advanced Engineering Mathematics, 10th Edition, John Wieley & Sons, Inc. 2013.

Course Code	**20B16CS322**	**Semester** Even	**Semester** VI **Session** 2021 -2022 **Month from Jan to Jun**
Course Name	**Java Programming**		
Credits	Audit	**Contact Hours**	[1- 0 - 2]

Faculty (Names)	**Coordinator(s)**	Dr. Shruti Jaiswal, Ms. Shradha Porwal
	Teacher(s) (Alphabetically)	Dr. Amarjeet Prajapati, Kashav Ajmera, Mr. Prantik Biswas, Dr. Raghu, Ms. Shradha Porwal, Dr. Shruti Jaiswal,

COURSE OUTCOMES At the completion of the course, Students will be able to		**COGNITIVE LEVELS**
C305-8.1	Write basic Java programs using Java constructs – loops, switch-case and arrays.	Understand Level (C2)

C305-8.2	Define all basic concepts related to OOP concepts	Remember Level (C1)
C305-8.3	Develop java programs using Java collection framework	Apply Level (C3)
C305-8.4	Create or design an application based on Java programming constructs	Create Level (C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Overview of OOA (Object Oriented Analysis) and Java basics	Classes, Objects, OOPs concept using JAVA, Packages and Interfaces.	3
2.	JVM Internals	Memory management, Garbage Collection	1
3.	String Handling	Using String and StringBuilder class. String Immutability(toString())	2
4.	Exception Handling in JAVA	Fundamentals, Exception types, Java built-in exceptions, Custom Exceptions, Chained Exceptions.	2
5.	Collections Framework	Collection Overview, List, Map (hashCode& Equals), Set, Queue & other collections	4
6.	Multithreading in Java	Multithreading overview and requirement, Thread state diagram, Java multithreading implementation (Thread/Runnable), Challenges in multithreading/Mutual Exclusion, Java handling of mutual exclusion (synchronization), Communication between threads (wait/notify)	2
		Total number of Lectures	14

Evaluation Criteria
Components   **Maximum Marks**
Mid Tern Evaluation   30
End Semester Examination   40
TA   30 (Attendance = 07, Quizzes = 08, Internal assessment = 07, Assignments in
                                   PBL mode = 08.)
Total   **100**

Project based learning:Assignments on different topics are given to each student. They utilize the java concepts and try to solve different problems given as assignments.
The course emphasized on the Skill development of studentsin Java Programming. Topics like inheritance, classes, exception handling,multithreading, collection frameworks, etc. are taught to enhance the programming skills of the students for making them ready for employability in software development companies.

Recommended Reading material:	
Text Books	
1.	Schildt, H. (2014). *Java: the complete reference*. McGraw-Hill Education Group.
2.	Bloch, J. (2016). *Effective java*. Pearson Education India.
Referenc Books	
1.	Sierra, K., & Bates, B. (2005). Head First Java: A Brain-Friendly Guide. " O'Reilly Media, Inc.".
2.	Mughal, K. A., & Rasmussen, R. W. (2003). A programmer's guide to Java certification: a comprehensive primer. Addison-Wesley Professional.

Detailed Syllabus

Course Code	20B16CS323	Semester Even (specify Odd/Even)	Semester VI Session 2021 -2022 Month from January to June
Course Name	Problem Solving using C and C++		
Credits	0	Contact Hours	[1- 0 - 2]

Faculty (Names)	Coordinator(s)	Ms. Anuradha Gupta, Dr. Vimal Kumar
	Teacher(s) (Alphabetically)	Akanksha Mendiratta, Anuradha Gupta, Bharat Kumar, Shilpa Budhkar, Sakshi Gupta, Vimal Kumar

COURSE OUTCOMES [NBA Code: C305-9] At the completion of the course, Students will be able to		COGNITIVE LEVELS
C305-9.1	Apply and use library functions, pointer arithmetic, arrays, and regular expressions and secure coding practices in programs.	Apply Level (C3)
C305-9.2	Use critical thinking skills and creativity to choose the appropriate containers, iterators and algorithms for a given problem.	Apply Level (C3)
C305-9.3	Demonstrate the use of concurrency principles, input and output streams and defensive techniques in programs.	Apply Level (C3)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Review and practice problems on Functions in C/C++	Functions, Alt function syntax, Function return type deduction, static, const and inline functions, default parameters, overloaded functions- operator and members, friends, overriding functions.	CO1
2.	Practice problems on Arrays and Pointers and Indirections	Smart pointers, pointers and dynamic memory allocation, type inference, array and pointers and their arithmetic and indirections	CO1
3.	Secure Coding practices in C/C++	Common String, Integer and dynamic memory allocation Errors, Integer and dynamic memory allocation and String vulnerabilities their mitigation strategies.	CO1
4.	String Localization and Regular Expression	Localization and working with regular expression, Programming with Regex library	CO2
5.	Practice problems on Exception Handing and Assertions	Errors and Exceptions, Exception Mechanisms, Exceptions and Polymorphism, Stack unwinding and Cleanup, Common error handling issues	CO2
6.	Applications with Disk Files and other I/O	Using streams, Input and Output with Streams, String Streams, File Streams and Bidirectional I/O	CO2
7.	Generic Programming with Templates	Class templates, Function templates, variable templates, Template parameters, Specialization	CO3

		of templates, template recursion, variadic templates, Meta-programming	
8.	Working with Standard Template Library	Understanding and working with containers, container adapters and iterators, Lambda expressions, Function objects, STL algorithms, Customize and extend STL	**CO3**
9.	Programming using Dynamic Memory Allocation Model	Working with dynamic memory, array-pointer duality, low level memory operations, smart pointers and common memory pitfalls	**CO3**
10.	Problems on Concurrency in Programming	Introduction, Threads, Atomic operations library, Mutual Exclusion, Conditional variables	**CO3**
			14

Evaluation Criteria

Components	Maximum Marks
Mid Tern Evaluation	30
End Semester Examination	40
TA	30 (Attendance = 07, Quizzes = 08, Internal assessment = 07, Assignments in PBL mode = 08.)
Total	**100**

Project based learning: Project based learning: Each student in a group of 2-4 will choose an industrial application for development. To fulfil the objective of this lab i.e., learning and applying the programming skills in C and C++. Students need to consider a trending industrial requirement for application development using the programming language skills learned. Understanding programming application development helps the students in enhancing knowledge on industry need of software design and development using programming languages.

Recommended Reading material:
Text Books
1. Schildt, H. (2003). C++: The complete reference. McGraw-Hill/Osborne.
2. Lafore, R. (2002). Object-oriented programming in C++. Pearson Education.
3. Deitel, P., & Deitel, H. (2016). C++ how to Program. Pearson.
Reference Books
1. Savitch, W. J., Mock, K., Msanjila, S., & Muiche, L. (2015). Problem Solving with C++. Pearson.
2. Seacord, R. C. (2005). Secure Coding in C and C++. Pearson Education.
3. Drozdek, A. (2012). Data Structures and algorithms in C++. Cengage Learning.

Detailed Syllabus

Course Code	20B16CS324	Semester Even	Semester VI Session 2021 -2022
			Month from Jan 2022 to Jun 2022

Course Name	**Non-linear Data Structures& problem solving**		
Credits	1	**Contact Hours**	1- 0 - 2

Faculty (Names)	Coordinator(s)	Dr. Manju (62), Varsha Garg (128)
	Teacher(s) (Alphabetically)	Dr. Ankit Vidyarthi, Dr. Manish Ku. Thakur, Dr. Manju, Nishtha, Mrs Varsha Garg

COURSE OUTCOMES At the completion of the course, Students will be able to		COGNITIVE LEVELS
C305-10.1	Demonstrate operations on different data structures.	Understand Level (C2)
C305-10.2	Use critical thinking skills and creativity to choose the appropriate data structure and solve the given problem.	Apply Level (C3)
C305-10.3	Identify the correctness and efficiency of the solution by constructing different test cases.	Apply Level (C3)
C305-10.4	Develop solutions to real world problems by incorporating the knowledge of data structures	Create Level (C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Review of Problem Solving and Data Structures	Concepts of Problem Solving, Performance metrics for Algorithm Analysis, Why study Data structures and Abstract Data Types. Practice problems on Sparse Matrix	1
2.	Practice problems on advanced list structures	Multi-list, skip list, XOR linked list, self organizing list, unrolled linked list	2
3.	Practice problems on point and range queries using tree structures	**Suffix array and suffix tree**, Trie and persistent trie, Segment tree and persistent segment tree, Interval tree, K dimensional tree, Binary indexed tree, Splay tree, Treap (randomized BST), Order statistics tree	4
4.	Practice problems on optimization problems using tree structures.	Tournament tree, Decision tree, Cartesian tree	2
5.	Practice problems on heaps and sets	Sparse set, Disjoint set, Leftist heap, K-aryheap	2
6.	Problem solving using graphs	Social graphs, Transportation system graphs, Resource allocation graphs	3
		Total number of Lectures	14

Evaluation Criteria
Components   **Maximum Marks**
Mid Tern Evaluation   30
End Semester Examination   40
TA   30 (Attendance – 10, Quizes/Mini Project – 20)
Total   **100**

Project based Learning: Each student in a group of 3-4 will develop a simulator with the help of various advanced data structures. Students will be able to understand and apply algorithms and advanced data structures properly; know how to evaluate, choose appropriate algorithms or data structures; know how to design and implement algorithms or data structures to serve the purpose of designing solution.Selecting t**heappropriate** data **structure** is an integral part of the programming and problem-solving process. The project typically incorporates various advanced data structure concepts to enable the synthesis of knowledge from real-life experiences.

	Recommended Reading material:
	Text Books
1.	Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Fourth Edition.
2.	Handbook of Data Structures and Applications, 2nd Edition by Sartaj Sahni, Dinesh P. Mehta, CRC Press
	References
3.	Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student edition, John Wiley and Sons.
4.	Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
5.	Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
6.	Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
7.	Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education

Detailed Syllabus
Lecture-wise Breakup

Course Code	20B16CS326	Semester EVEN	Semester VI Session 2021 -2022 Month from JAN-JUN
Course Name	Front End Programming		
Credits		**Contact Hours**	1-0-2

Faculty (Names)	**Coordinator(s)**	Mr. Janardan Verma (J62), Dr. Shailesh Kumar(J128)
	Teacher(s) (Alphabetically)	Janardan Verma, Kapil Madan, Kritika Rani, MahendraGurve, Shailesh Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C305-11.1	Demonstrate new technologies by applying foundation paradigms	Understanding [Level 2]
C305-11.2	Build strong foundations for basic front end tools & technologies thereby making them understand the application development lifecycle.	Apply [Level 3]
C305-11.3	Develop elegant and responsive Front-end by leveraging latest technologies	Apply [Level 3]
C305-11.4	Explain activity creation and Android UI designing	Understanding [Level 2]
C305-11.5	Develop an integrated mobile application to solve any complex real time problem	Create [Level 6]

Module No.	Title of the Module	Topics in the Module	No. of Lectures for

1.	Object Oriented Programming Concepts	Objects, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism	1
2.	Introduction to basic front end techniques	HTML 5, CSS 3, Javascript, jquery, bootstrap	3
3.	Java Fundamentals	Decision Making, Loop Control, Operators, Array, String, Overloading, Inheritance, Encapsulation, Polymorphism, Abstraction	2
4.	Advanced Front End Programming Concepts	Storing and retrieving data, Python Programming Concepts, Python for developing Android Application.	2
5.	Designing Android Application	Android development lifecycle, Learning UI and layout, controller, component, Directives, Services & views.	3
6.	Android with Database	Data base Application Development	2
7.	Privacy & Security Issues	Security Issues with Android Platform	1
		Total number of Lectures	**14**

Evaluation Criteria

Components   **Maximum Marks**
 Mid Semester Examination   30
 End Semester Examination   40
 TA   30 (**Attendance-10,Assignments/ Class Test/ Quiz/ LAB Record -05, Project-15**)

Total   **100**

Project based learning: In this subject students will learn the latest front end technology. After completing the subject, each student in a group of 3-4 will be able to create a mobile application.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
Reference Books:
1.	Schildt, H. (2014). Java: The Complete Reference. McGraw-Hill Education Group.
2.	Mughal, K. A., & Rasmussen, R. W. (2016). A Programmer's Guide to Java SE 8 Oracle Certified Associate (OCA). Addison-Wesley Professional.
3.	Gaddis, T., Bhattacharjee, A. K., & Mukherjee, S. (2015). Starting out with Java: early objects. Pearson.
Text Books:
4.	Duckett, J. (2014). Web Design with HTML, CSS, JavaScript and jQuery Set. Wiley Publishing.
5.	Shenoy, A., &Sossou, U. (2014). Learning Bootstrap. Packt Publishing Ltd.
6.	Lee, W. M. (2012). Beginning android for application Development. John Wiley & Sons.
7.	Hardy, B., & Phillips, B. (2013). Android Programming: The Big Nerd Ranch Guide. Addison-Wesley

	Professional.	

Detailed Syllabus
Lecture-wise Breakup

Subject Code	21B12CS312	Semester: EVEN SEM	Semester 6th Session 2021-2022
			Month from Feb to June 2022
Subject Name	**Sensor Technology and Android Programming**		
Credits	**03**	**Contact Hours**	**3 -0 -0**

Faculty (Names)	Coordinator(s)	Hema N, SHARIQ MURTUZA
	Teacher(s) (Alphabetically)	Hema N, SHARIQ MURTUZA

COURSE OUTCOMES After the completion of the course, the students will be able to	COGNITIVE LEVELS
C331-1.1	Understand the sensor, smart sensors and various platform of sensing devices	Level-1 (Remembering)
C331-1.2	Understand Anatomy of an android development environment (IDE) for sensing application	Level-2 (Understanding)
C331-1.3	Accessing various physical sensors of the Android device and its programming	Level-3 (Applying)
C331-1.4	Develop various user services/app using Android and sensors	Level-6 (Create)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	**Fundamentals of Sensors**	**Sensing and Sensor Fundamentals:** Sensing Modalities, Mechanical Sensors, MEMS Sensors, Optical Sensors, Semiconductor Sensors, Electrochemical Sensors, Biosensors **Key Sensor Technology Components- Hardware and Software Overview:** Smart Sensors, Sensor Systems, Sensor Platforms, Microcontrollers for Smart Sensors, Microcontroller Software and Debugging	9

2.	Introduction to Android Programming	**Overview of the Android Platform:** Introducing Android, Setting Up Your Android Development Environment. **Android Application Basics:** Anatomy of an Android Application, Android Manifest File, Managing Application Resources. **Android User Interface Design Essentials:** Exploring User Interface Building Blocks, Designing with Layouts, Partitioning the User Interface with Fragments, Displaying Dialogs.	9
3.	Inferring Information from Physical Sensors	**Overview of Physical Sensors,** Android Sensor API, Sensing the Environment, Sensing Device Orientation and Movement. **Detecting Movement:** Acceleration Data. **Sensing the Environment:** Barometer vs. GPS for Altitude Data **Android Open Accessory (AOA):** AOA Sensors versus Native Device Sensors, AOA Beyond Sensors, AOA Limitations, AOA and Sensing Temperature	8
4.	Sensing the Augmented, Pattern-Rich External World	RFID, Near field communication (NFC), Inventory Tracking System using NFC, Camera Activity, Barcode Reader, Image-Processing using AOA, Android Clapper and Media Recorder.	8
5.	Development of user Services using Android and Sensors	Development of android services such as motion detection, Air Monitoring, Screen Brightness Monitoring, Acceleration, Position, Air Pressure Monitoring, and Monitor of Temperature	8
		Total number of Lectures	**42**

Evaluation Criteria Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 {(Quiz + Project Assignment +Class Test)→15+ Attendance→10}
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc)	
1.	Greg Milette, Adam Stroud, "Professional Android Sensor Programming", ISBN: 978-1-118-18348-9, Wiley June 2012
2.	McGrath, Michael J., Cliodhna Ni Scanaill, and Dawn Nafus. "*Sensor technologies: healthcare, wellness, and environmental applications*". Springer Nature, 2013.
3.	Annuzzi, Joseph, Lauren Darcey, and Shane Conder. *Introduction to Android application development: Android essentials*. Pearson Education, 2014.

4.	Fraden, Jacob. Handbook of Modern Sensors: Physics, Designs, and Applications. Germany, Springer International Publishing, 2015.
5.	Advances in Modern Sensors: Physics, design, simulation and applications (IOP Series in Sensors and Sensor Systems) Hardcover – Import, 16 November 2020 by G R Sinha
6.	Horton, John. Android Programming for Beginners. United Kingdom, Packt Publishing, 2015.
7.	Kurniawan, Budi. *Introduction to Android Application Development*. Brainy Software Inc, 2014.

Project based learning: Learning smart sensors of android devices, student can write, read, and analyze graphical data of any connected android device from anywhere in the world. Students will get employment in sensor-based and android app firms. Group project will be given to the students to design custom based android application/services which access the various sensors of the android devices remotely. Depending on the services and its popularity, one can even have a start-up company for the same.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	21B12CS313	Semester (Even)	Semester Even Session 2021 - 22 Month from January to June 2022
Subject Name	Fundamentals of Distributed and Cloud Computing		
Credits	3	Contact Hours	3 Lectures

Faculty (Names)	Coordinator(s)	Dr. Rashmi Kushwah
	Teacher(s) (Alphabetically)	1. Dr. Rashmi Kushwah 2. Dr. Parmeet Kaur 3. Dr. Prakash Kumar

COURSE OUTCOMES		COGNITIVE LEVELS
C331-2.1	Identify and solve event ordering related problems occurring due to various synchronization related issues in distributed systems.	Apply (Level 3)
C331-2.2	Compare analysis for Distributed Mutual exclusions and deadlock handling techniques in distributed environments.	Understand (Level 2)
C331-2.3	Evaluate data consistency, replication and fault related issues for various distributed scenarios.	Evaluate (Level 5)
C331-2.4	Understand various Deployment Models, Cloud Service Models, Essential Characteristics, Foundational Elements and Enablers, Cloud Architecture.	Understand (Level 2)
C331-2.5	Analyze various Virtualization Techniques, Virtual Machine Provisioning, Migration techniques, containerization and their performances in cloud environments.	Analyze (Level 4)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures

			for the module
1.	Review of operating systems principles, Theoretical foundations to Distributed Systems.	Review of Operating Systems principles, Introduction to Distributed Systems concepts.	3
2.	Synchronization mechanisms in Distributed Systems	Resource models. Clock synchronization. Event ordering. Timestamps recording. Global state collection mechanisms.	3
3.	Election Algorithms and Termination Detections	Election Algorithms: Ring and Bully Algorithms, Termination Detection,	2
4.	Distributed Mutual Exclusion (DME) Algorithms	Distributed mutual exclusion. Token and non-token based algorithms. Comparative performance analysis.	4
5.	Distributed Deadlock Detection Algorithms	Process deadlocks in DS. Deadlock handling techniques.	3
6.	Agreement Protocols	System Model, Classification, Byzantine Problems and solutions.	2
7.	Consistency and Replication Issues	Data-centric consistencies, Client-centric consistencies. Epidemic Protocols.	5
8.	Fault Tolerance and Reliability	Fault Tolerance, Reliability in Distributed Systems, group communications, and Distributed commit. Failure Recovery.	5
9.	Introduction to Cloud Computing	Introduction to cloud computing, Correlation between Distributed and Cloud Models.	2
10.	Cloud services and models	Deployment Models, Service models, SaaS, PaaS, IaaS. Essential Characteristics, Foundational Elements, Enabling Technologies for Cloud.	3
11.	Virtualization Technology, Virtual Machines(VMs) and Containerization	Virtualization Technology, Virtualization Techniques, Virtual Machines, Virtual Machine Monitors, Live Migrations, Virtual Clusters, Containers and overview of Dockers	8
12.	Cloud Security	Data and Network security in cloud, Access control and authentication in cloud computing.	2
			42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Project Based Learning:15, Assignments:5, Attendance:5)
Total	**100**

Project Based Learning: A group of maximum 4 students are to be formed. Each group shall choose a Distributed Systems and/or Cloud based project. The project shall be designed and/or modeled either

based on Distributed Systems algorithms and scheduling techniques, and/or any Cloud Platform like AWS, Google cloud, Eucalyptus, CloudSim, iFogSim or any simulation tools. The project shall function and run as per the objective of the project. Live demonstration of the project shall be shown during their presentation. The project evaluation shall be done based on the quality, innovation, relevance and creativity involved.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text books

1.	Tanenbaum, A.S, Marten, V. Steen, Distributed Systems : Principles and Paradigms, 2nd Edition, Prentice Hall. Reprint 2015.
2.	M. Singhal, N. G. Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw-Hill. 2012.
3.	K. Hwang, Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing- From Parallel Processing to the Internet of Things", Morgan Kauffman Publishers, Elsevier. 2014.
4.	R. K. Buyya, J Broberg, Adnrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley Publisher. 2014
5	Barrie Sosinsky, "Cloud Computing Bible" Wiley India Publishers, 2013.

References

6.	Tanenbaum, A. S Distributed Operating Systems, 1st Ed., Prentice-Hall, Englewood Cliffs, NJ.
7.	"Introduction to Cloud Computing Architecture" Sun's White Paper, 1st Edition, June, 2009.
8.	Dan C. Marinescu, "Cloud Computing: Theory and Practice", Morgan Kauffman Publishers, Elsevier.
9.	Rich Uhlig, et. al., "Intel Virtualization Technology" IEEE Journal, 2005.
10.	"Implementing Virtualization" White paper, Intel virtualization Technology, 2008